NUCLEAR SCIENCE ABSTRACTS

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UNITED STATES ATOMIC ENERGY COMMISSION
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NUCLEAR SCIENCE ABSTRACTS

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The printing of this publication has been approved by the Director of the Bureau of the Budget, July 30, 1957.

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ERRATA

NSA Vol. 10, No. 17, p. 804. In abstract 6658, delete secondary number LMFR-9.

NSA Vol. 10, No. 22, p. 1308. In abstract 11244, J. L. Putmen should be J. L. Putman.

NSA Vol. 10, No. 21, p. 1275. In abstract 10962, KAPL-M-JHP-4 should be KAPL-M-JP-4.

NUCLEAR SCIENCE ABSTRACTS

Volume 12 Number 20 October 31, 1958

GENERAL

13639 AECL-674
Atomic Energy of Canada Ltd., Ottawa.
ANNUAL REPORT, 1957-58. 28p.

The annual report of AECL, together with the balance sheet, statement of retained earnings, statement of income and expense, and auditor's report, covering the period April 1, 1957, to March 31, 1958, is submitted. (W.D.M.)

13640 BNL-484
Brookhaven National Lab., Upton, N. Y.
QUARTERLY PROGRESS REPORT [FOR] OCTOBER 1-DECEMBER 31, 1957. 57p. $1.75(OTS).

Abstracts of reports on physics, chemistry, biology, and medicine which are being published concurrently in scientific journals are presented. Status of research on the Cosmotron, accelerator development, reactor and nuclear engineering, and instrumentation and health physics are included. (For preceding period see BNL-473.) (J.E.D.)

13641 K-1390
Oak Ridge Gaseous Diffusion Plant, Tenn.
A STUDY OF STUDENT-COMPANY DECISIONS IN TECHNICAL RECRUITING. John Paul Blakley and William Charles Kuykendall. May 26, 1958. 76p. Contract W-7405-eng-26. $2.00(OTS).

Information obtained from 897 technical students who took part in various phases of the recruiting program of a large chemical company during the 1956-57 school year is analyzed. (W.D.M.)

13642 NP-6829
Australia. Atomic Energy Commission.
SYMPOSIUM ON THE PEACEFUL USES OF ATOMIC ENERGY IN AUSTRALIA, 1958, HELD IN SYDNEY IN JUNE 1958. 246p., 2 illus.

Thirty-nine papers presented at the conference are collected here. The papers are divided into five sections: Materials, Power Engineering, Power Auxiliaries and Research Reactors, Basic Sciences, and Associated Techniques. Separate abstracts of each section have been prepared. (T.R.H.)

13643 NP-6829(Sect. 1)
Australia. Atomic Energy Commission.
MATERIALS. Sect. 1 [of] SYMPOSIUM ON THE PEACEFUL USES OF ATOMIC ENERGY IN AUSTRALIA, 1958, HELD IN SYDNEY IN JUNE 1958. 107p., 2 illus.

The environments of the known uranium occurrences in South Australia are described, and the relation of uranium mineralization with sodic granitic rocks is emphasized. The problems in designing equipment for radiometric prospecting are reviewed. The fabrication and properties of BeO, UO_2, ThO_2, and mixed oxides are discussed. The use of pulsing in a uranium extraction pilot plant ion exchange column is described. The wetting of metals by liquid metals is reviewed with emphasis on liquid sodium. The geological nature, extent, and future prospects of minerals with atomic energy applications, occurring in New South Wales are outlined. The development of a process for uranium recovery from Mary Kathleen ores is described. Techniques and processes involved in locating, mining, and concentrating davidite-type ores at Radium Hill, South Australia are described. The uranium deposits of the Northern Territory, Australia, are classified and described. The flotation behavior of the simple oxide minerals, uraninite and the colloform variety is discussed. The Port Pirie Treatment Plant for uranium recovery from refractory Radium Hill concentrates is described. The plant utilizes the sulfuric acid-ion exchange process. The uranium deposits of Queensland are described. The details of the production of uranium ore concentrates at Rum Jungle near Darwin, Australia, are given. A brief account of the use of neutron diffraction analysis in crystallography is given, and the neutron spectrometers installed on the High Flux Australian Research Reactor are described. (T.R.H.)

13644 NP-6829(Sect. 2)
Australia. Atomic Energy Commission.
POWER ENGINEERING. Sect. 2 [of] SYMPOSIUM ON THE PEACEFUL USES OF ATOMIC ENERGY IN AUSTRALIA, 1958, HELD IN SYDNEY IN JUNE 1958. 34p.

Power reactor development in the United States since World War II is summarized. The applications of nuclear power as opposed to coal in Australia are considered. The need for a nationally integrated fuel cycle for Australia is stressed, and fissile and fertile material requirements are estimated. The Canadian power reactor development program is described. The liquid metal fuel reactor is compared with other power reactor types. (T.R.H.)

13645 NP-6829(Sect. 3)
Australia. Atomic Energy Commission.
POWER AUXILIARIES AND RESEARCH REACTORS. Sect. 3 [of] SYMPOSIUM ON THE PEACEFUL USES OF ATOMIC ENERGY IN AUSTRALIA, 1958, HELD IN SYDNEY IN JUNE 1958. 28p.

The problems of disposing of the large amounts of highly-radioactive waste resulting from a large-scale nuclear power program are reviewed. The Canadian research reactor NRX is discussed. The DIDO reactor is briefly described and operating experience for the first year at high flux is summarized. The core of the

High Flux Australian Research Reactor (HIFAR) is described, and some reactivity balance data are given. (T.R.H.)

13646 NP-6829(Sect.4)
Australia. Atomic Energy Commission.
BASIC SCIENCES. Sect. 4 [of] SYMPOSIUM ON THE PEACEFUL USES OF ATOMIC ENERGY IN AUSTRALIA, 1958, HELD IN SYDNEY IN JUNE 1958. 19p.

A detector array for study of air showers of 10^5 to 10^7 particles is described. The punched paper tape data recording device is also described. Experiments in which the zenith angle distribution of air showers in the range 10^5 to 10^7 particles was obtained are reported. The results of studies of the Cherenkov light from air shower particles during passage through the atmosphere are given. Molecular iodine containing I^{131} was used to free radicals in hydrocarbons under ionizing radiation in high vacuum. The possibilities of using the $Fe^{56}(n,p)$ reaction as a threshold detector for fast neutrons were investigated. (T.R.H.)

13647 NP-6829(Sect.5)
Australia. Atomic Energy Commission.
ASSOCIATED TECHNIQUES. Sect. 5 [of] SYMPOSIUM ON THE PEACEFUL USES OF ATOMIC ENERGY IN AUSTRALIA, 1958, HELD IN SYDNEY IN JUNE 1958. 53p.

A brief survey of reported temperature effects in Geiger-Mueller tubes is followed by a description of experiments on organic-quenched tubes with oxide-coated cathodes. Methods of determining liver blood flow are reviewed and the inaccuracies of the method employing the blood disappearance rate of injected Au^{198} colloid are pointed out. A method is given for locating the placenta using radioisotopes. Using serum albumin containing I^{131} and a counter placed over the chest, passage of blood through the heart and great vessels may be recorded. The facilities at the Atomic Energy Research Establishment for handling plutonium and irradiated uranium are described. An electrometer circuit design is given wherein both anode and cathode of an input electrometer tube are made to follow closely the input signal. Radiation hazards and permissible doses are discussed generally. An experimental study of the equilibrium turnover of thyroxine in the thyroid gland is reported. The use of transistor decade scaling circuits in radiation counters is discussed. (T.R.H.)

13648 TID-3076
Technical Information Service Extension, AEC.
ISOTOPES: BIBLIOGRAPHY OF UNITED STATES RESEARCH AND APPLICATION—1955-1957. J. A. McCormick, comp. May 1958. 267p. $2.25(OTS).

A bibliography as a guide to the technical aspects of isotope research and application is presented. Nearly 600 references are categorized into 30 fields of work with radioactive and stable isotopes. The bibliography is restricted to published literature references. Unclassified and declassified reports written by investigators working in AEC laboratories, but not published in open literature are not included. An author index and a key to journal abbreviations are included. Reference titles are listed alphabetically within the categories of isotope uses. (J.E.D.)

Atomic Power

13649 TID-3085
Technical Information Service Extension, AEC.
NUCLEAR SCIENCE AND TECHNOLOGY. A Selective Bibliography. May 1958. 248p. $4.00(OTS).

This annotated bibliography contains 1619 selected references to United States Atomic Energy Commission reports, technical books, and articles in technical journals. Author and report number indexes with availability information are included. (auth)

13650
NUCLEAR ENERGY DEVELOPMENT AS A PROBLEM OF MAN-POWER. Nature 182, 343-5(1958) Aug. 9.

The development of the nuclear power program in Great Britain in 1958 is reviewed. (C.H.)

13651
PRODUCTIVE USES OF NUCLEAR ENERGY. REPORTS ON THE NUCLEAR ENERGY AND THE U. S. FUEL ECONOMY, 1955-1980. Perry D. Teitelbaum. Washington, National Planning Association, 1958. 198p. $3.00.

The fuel economy of the United States in the years from 1955 to 1980 is analyzed. The study is not confined to electric power, but includes other applications of nuclear energy, such as process heat and propulsion. The competitive interrelationships likely to prevail in the fuel economy are emphasized. The general order of the contribution of nuclear energy to the fuel and energy requirements is assessed over the next several decades. The necessity for public and private policies for coal, oil, gas, and nuclear energy is stressed. (J.S.R.)

BIOLOGY AND MEDICINE

13652 BNL-474
Brookhaven National Lab., Upton, N. Y.
HOMEOSTATIC MECHANISMS. REPORT OF SYMPOSIUM HELD JUNE 12 TO 14, 1957. Brookhaven Symposia in Biology No. 10. 276p. $3.00(OTS).

Problems associated with studies on cellular equilibria are reviewed. Data are presented from studies on those homeostatic processes which are involved in controlling concentration of the formed elements of the blood. A subject index and lists of speakers and participants in the symposium are included. (C.H.)

13653 AEC-tr-3332
BIOCHEMISTRY OF BACTERIOPHAGY. B. I. Klein. Translated for Oak Ridge National Lab. from Uspekhi Sovremennoĭ Biol. 37, 291-304(1954). 36p.

The influence of the bacteriophage on the enzymatic systems of the bacterial cell and the biochemistry of bacteriophagy was examined. No uniform conclusions have been reached concerning the exact nature of bacteriophagy, and the phage's penetration into the cell is not understood. The biochemistry of the interaction between phage and bacterial cell and the separate study of each process are the most recent approaches. It is pointed out that recent advances have made it possible to come close to the determination of that component which the bacteriophage introduces into the general metabolism of the bacterial cell in the bacteriophagy process, and the author believes that most problems will be resolved in the near future. (J.R.D.)

13654
THE DISTRIBUTION OF ALPHA-RADIOACTIVITY IN NATIVE VEGETATION. J. T. Curtis and Ralph Dix (Univ. of Wisconsin, Madison). Botan. Gaz. 117, No. 3, 233-8(1956) Mar.

Analysis of the soil and of the plants in a variety of plant communities for alpha-emitting substances showed that a considerable concentration occurred in the A_0

soil layer. This concentration was greatest in coniferous forests growing on loess-free, igneous soils in cool climates. The humus beneath hemlock trees showed the greatest alpha radioactivity. A number of rare elements were found to be similarly concentrated in the humus of coniferous forests, including Cu, Ga, Pb, and Zr. The high concentrations reached by these elements indicate that immediate soil environment of tree seedlings may be very different from that expected in ordinary soil analyses in the region. (auth)

13655

THE UPTAKE OF LIPOPROTEINS BY ASCITES TUMOR CELLS. THE FATTY ACID-ALBUMIN COMPLEX. Dorothy L. Fillerup, Joseph C. Migliore, and James F. Mead (Univ. of California, Los Angeles). J. Biol. Chem. 233, 98-101(1958) July.

The absorption of palmitic acid-1-C^{14} by ascites tumor cells was studied in vitro. Palmitate was metabolized more rapidly from its albumin complex than from buffer alone, but the albumin carrier was not absorbed or metabolized. Cyanide-inhibited cells absorbed palmitate from the medium but did not metabolize it. The process of absorption was thus revealed as a distribution of fatty acid between the medium and the inert cell surface probably followed by an active transfer of the fatty acid into the cell for oxidation. (auth)

13656

PHOSPHORESCENCE IN LIQUID SCINTILLATION COUNTING OF PROTEINS. Richard J. Herberg (Lilly Research Labs., Indianapolis). Science 128, 199-200 (1958) July 25.

In the investigation of alcoholic solutions of the quaternary base Hyamine for the counting of proteins and tissues, a phosphorescence phenomenon was encountered when working with larger weights of the substances. The protein-Hyamine solutions were usually heated between 50 and 70°C for periods ranging from ½ hr to several hours. A count rate between 20,000 and 300,000 counts/min was observed with Hyamine-toluene-protein solutions of 100 mg portions of proteins. Solutions containing no toluene exhibited a phosphorescence which, however, was not as large. The count rate of both solutions would be increased by exposure to an incandescent lamp. The count rate decreased regularly, but slowly. The Hyamine solutions without protein showed no count. The cause of the phosphorescence is not known. (J.S.R.)

13657

ATOMIC BOMB EFFECT: VARIATION OF RADIOCARBON IN PLANTS, SHELLS, AND SNAILS IN THE PAST FOUR YEARS. H. de Vries (Natuurkundig Laboratorium, Groningen, Netherlands). Science 128, 250-1(1958) Aug. 1.

The C^{14} content in sea mussels, land snails, fresh water mollusks, and algae was determined. The activities for both flesh and shell are tabulated as differences from the standard. As a check on the fractionation during growth, the C^{13} content was also measured. An increase of 4.3% in the C^{14} content in the flesh of the land snail was observed between November 1953 and June 1957. There was only an increase of 1% in the shells. Isotopic fractionation and environmental differences are discussed. (J.S.R.)

13658

COMMON STRONTIUM CONTENT OF THE HUMAN SKELETON. D. L. Thurber, J. L. Kulp, E. Hodges, P. W. Gast, and J. M. Wampler (Columbia Univ., New York). Science 128, 256-7(1958) Aug. 1.

An investigation was made of the strontium content of human bone to determine the distribution of strontium among the different bones in an individual skeleton, to determine the distribution of strontium in the population of a single city, and to extend the information on geographical variations. Although the average strontium content of the whole skeleton of an individual varied by a factor of 3, there was no systematic difference between any two bones of the body. A histogram of the strontium concentration in 133 individuals from New York City shows a nearly normal distribution. The data on the concentration of strontium in human bone in various geographical localities are tabulated. (J.S.R.)

Radiation Effects

13659 HW-56414

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

EFFECT OF INTESTINAL TRACT IRRADIATION ON SERUM PROTEINS OF THE RAT. R. F. Palmer and M. F. Sullivan. June 17, 1958. 10p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Electrophoretic fractionation of the sera of rats following exposure of their intestinal tracts to x-radiation showed marked effects on the serum protein pattern. Oral administration of Y^{91} showed similar, but somewhat delayed effects. Decrease in serum albumin was used to correlate dosage and its effect on serum proteins. (auth)

13660 NP-6861

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

INFLUENCE IN VITRO OF IONIZING RADIATION ON THE BLOOD CLOTTING SYSTEM. Report No. 14/XRb. Z. Latałło, A. Dancewicz, and T. Musiałowicz. Mar. 1958. 14p.

Behavior of the clotting system after exposure of its components to x rays in doses of up to 13,200 r was studied. A small extension of recalcification time in irradiated platelet-poor plasma and deficiency of thromboplastic function after irradiation of platelets and Christmas factor were revealed. No pronounced effect of x-rays on the second clotting phase could be demonstrated. Prothrombin time was found to be extended. Inactivation of plasminogen was not confirmed. Differences in behavior of the fibrinolytic system before and after irradiation were not revealed. (auth)

13661 ORO-174

Tennessee. Univ., Knoxville.

AGRICULTURAL RESEARCH PROGRAM. Semi-Annual Progress Report for July 1, 1957 to December 31, 1957. 47p. Contract AT-40-1-GEN-242. $1.25(OTS).

The program on seed and plant irradiation was continued with additional studies on the irradiation of pollen and plant material as a means of producing mutations. Factors which influence the metabolism of cesium-134 and potassium-42 were studied in rats, sheep, and steers. Conventional and radiochemical procedures were employed in studies on the effect of stilbestrol on metabolism of calcium, phosphorus, and nitrogen in rats, sheep, lambs, and steers. The effects of irradiation on reproductive physiology were investigated in rats and cattle. Burros were exposed to the effects of prompt irradiation from a fission weapon detonation at the Nevada Test Site. Evaluation of the results is in progress. Data are reported on the response of burros previously exposed to lethal doses of whole-body irradiation. Cattle were exposed to five different doses of whole-body gamma irradiation in the median lethal

range. Data are tabulated on the mortality response. A schematic sketch is included of a rotating-head sample changer for liquid scintillation counting. (For preceding period see ORO-169.) (C.H.)

13662 UR-526

Rochester, N. Y. Univ. Atomic Energy Project. INDIRECT EFFECTS OF X-IRRADIATION ON THE THYROID OF THE CHICK EMBRYO. F. T. Brayer, S. R. Glasser, G. W. Casarett, and J. W. Howland. June 12, 1958. 22p. Contract W-7401-eng-49. $4.80 (ph OTS); $2.70(mf OTS).

The I-131 uptake by the thyroid of the 12 to 17 day old chick embryo is significantly elevated 24 hours after exposure to 600r of x-irradiation. A comparable increase in the thyroidal uptake of I-131 can be elicited by injecting 0.1 ml. of pooled sera from x-irradiated chick embryos into untreated embryos. Injected purified, bovine thyrotrophic hormone also significantly increases thyroidal uptake of I-131 in the chick embryo. Histologic sections from x-irradiated embryos, embryos injected with pooled sera obtained from x-irradiated embryos, and embryos injected with purified bovine or crude avian thyrotrophic hormone all show a qualitatively similar regional stimulation of thyroid tissue. It is concluded from the data that exposure of the chick embryo to x-irradiation releases a substance into the systemic circulation which mediates the demonstrated significant increase in I-131 uptake by the thyroid and that this substance is thyrotrophic hormone. (auth)

13663

DOSAGE AND BIOLOGICAL EFFECTS OF EXTERNAL RADIATION SOURCES. John S. Laughlin (Sloan-Kettering Inst., New York). Arch. Ind. Health 18, 102-5 (1958) Aug.

The biological effects of external exposure to ionizing radiations are reviewed. (C.H.)

13664

RADIATION-INDUCED GENE MUTATION IN ADULT FEMALE AND FOETAL MALE MICE. T. C. Carter (Medical Research Council's Radiobiological Research Unit, Harwell, Berks, Eng.). Brit. J. Radiol. 31, 407-11 (1958) Aug.

Two experiments are reported in which foetal male mice were exposed to acute x irradiation and adult females to chronic γ irradiation. In each case the induced mutation rate of seven specific genes was lower than that observed by W. L. Russell following acute x irradiation of the adult male. There are important implications for radiation protection if these relationships hold good for man also. (auth)

13665

THE EFFECT PRODUCED BY IONIZING RADIATIONS UPON THE ACTIVITY OF LIPOXIDASE IN SEEDLINGS OF VARIOUS PLANT SPECIES. E. V. Budnitskaya, I. G. Borisova, and A. G. Passynskii (Bakh Inst. of Biochemistry). Doklady Akad. Nauk S.S.S.R. 120, 140-3 (1958) May 1. (In Russian)

Effects of ionizing radiation on the activity of lipoxidase in vivo on soya bean, peas, beans, wheat, and corn were investigated. It was observed that ionizing radiation induced changes in the lipoxidase system at much lower doses in vivo than in vitro, and that the activation in the fermenting system is present at small doses and short incubation period after radiation. (R.V.J.)

13666

A STUDY OF THE EFFECT OF NEUTRONS ON DRY CARYOPSIS IN DIPLOID AND TETRAPLOID WINTER RYE. L. P. Breslavets and Z. F. Mileshko (Inst. of Biological Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 120, 429-30(1958) May 11. (In Russian)

Radiosensitivity of dry caryopsis of diploid and tetraploid rye irradiated by various doses of thermal neutrons for ½, 1, 2, 3, 6, and 9 hr was studied, and the data obtained are tabulated. (R.V.J.)

13667

THE EFFECT OF FRACTIONATED X-RAY TREATMENT ON THE OVARY OF MICE. O. N. Kitaeva. Doklady Akad. Nauk S.S.S.R. 120, 514-17(1958) May 21. (In Russian)

Results revealed a reduced damaging effect on mice ovaries in treatments with a fractionated dose of 30 r. Data agreed with the results obtained in chronic irradiation which showed that the estrus cycle disturbance in mice appeared after a much larger total dose of chronic γ irradiation than after a single x-ray irradiation. (R.V.J.)

13668

RADIOSENSITIVITY OF THE CELL CONTENTS. L. P. Breslavets (Inst. of Biophysics, Academy of Sciences of the USSR, Moscow). Izvest. Akad. Nauk S.S.S.R. Ser. Biol. No. 3, 282-90(1958) May-June. (In Russian)

Radiosensitivity of various structural elements of the cell and of its contents has so far been treated in such a way as to find out which of them should be considered most susceptible. Data indicate that radiosensitivity of the structure elements and of contents of the cell depends on the kind of organ in which they are located. The nucleus is the most radiosensitive in dividing or free cells (animal sperm cells and ova, spores of plants) but can be less radiosensitive than plastids or mitochondria in the cells of resting tissues (mesophylla of the adult leaf). (tr-auth)

13669

ON THE CHANGES IN THE CHARACTER OF CERTAIN VEGETATIVE REACTIONS IN CONNECTION WITH THE EFFECT OF IONIZING RADIATION. N. P. Smirnova. Med. Radiol. 3, 3-9(1958) May-June. (In Russian)

A study was made of the functional influence of the hypothalamic area in general massive x irradiation. The vascular reaction of the rabbit's ear appearing in response to the electric stimulation of the hypothalamus was chosen as a test. A method of chronic implantation of the electrodes was used. The vascular reactions were judged by the registration of changes in the temperature. In the majority of rabbits the vascular reaction, which appears before irradiation in response to the stimulation of the hypothalamus, takes place in the form of constriction. After general irradiation by x-ray doses of 800 and 1000 r the character of the vascular reaction is changed. Experiments with the ganglioparalizer hexonium, as well as with the sympathetic denervation of the ear, demonstrated that the humoral factor plays a certain role in the transmission of excitation from the hypothalamic area to the constrictive elements of the vascular wall. (tr-auth)

13670

ON THE NERVOUS REGULATION OF AUTOLYSIS IN THE IRRADIATED ORGANISM. Z. B. Tokarskaya (Central Research Inst. of Roentgen-Radiology, Ministry of Health, USSR). Med. Radiol. 3, 26-9(1958) May-June. (In Russian)

Rabbits were subjected to a general radiation dose of 1,300 r in 2 weeks after denervation of various organs (the spleen, liver, kidney, or muscles). In 2 weeks after denervation there is an increase of autolysis by 32% in

the spleen, by 36% in the liver, by 24% in the kidney, and by 36% in the muscles. Following denervation and irradiation (on the 2nd day) the process of autolysis in the spleen and muscle was found to be much greater than after irradiation alone (in denervated and irradiated spleen—211%, in irradiated spleen—147%, in muscles 296% and 172% respectively). In case of liver and kidneys the autolysis in both experiments was almost equal (148% and 147% in case of liver and 108% and 114% in case of kidney, respectively). (tr-auth)

13671

CERTAIN OBSERVATIONS OF MICE SUBJECTED TO IRRADIATION BY X-RAYS IN LETHAL DOSES. Zh. Lambrev and Zh. Zlatarev (Pavlov Medical Inst.). Med. Radiol. 3, 30-4(1958) May-June. (In Russian)

The effect of sex, weight, and biogenetic stimulators were studied on the course of radiation sickness on mice. Female mice are more enduring than the males. Their mortality rate is considerably lower. Mice with low initial weight perished quicker. The extracts of human placenta and unplanted tissues of the spleen did not decrease the death rate and did not help these animals to preserve their initial weight. (tr-auth)

13672

CARBOHYDRATE-PHOSPHORUS METABOLISM IN EXPERIMENTALLY INDUCED ACUTE RADIATION SICKNESS. D. A. Golubentsev. Med. Radiol. 3, 35-7 (1958) May-June. (In Russian)

The sickness was caused by the general x-ray irradiation in doses of 400 to 800 r in dogs, 1000 to 1500 r in rabbits, and 750 r in rats. After the irradiation the sensitivity to insulin is considerably changed. This sensitivity shows a decline during the first 24 hours; it is greatly increased on the 5th to 25th day and remains in this condition in survived animals during the second month after the irradiation. The hyperglycemic effect of adrenalin is not changed during the latent period of this disease and is weakened during its acute stage. The glycogenolytic effect of adrenalin towards the muscular glycogen is enhanced during the acute stage of the disease. The stimulating effect exerted by adrenalin on hepatic and myocardial glycogenesis is distinct during this period of the disease. The pathogenetic significance of the changes of carbohydrate metabolism and its importance for the clinical picture is discussed. (tr-auth)

13673

CONCERNING THE MECHANISM OF DISTURBANCE OF INTESTINAL ABSORPTION OF GLYCOCOL FOLLOWING X-RAY IRRADIATION. V. A. Shaternikov. Med. Radiol. 3, 37-42(1958) May-June. (In Russian)

Absorption of glycocol from its hypertonic (M/2) and isotonic (M/3) solutions was examined in an isolated Tiery intestinal loop. At the same time it was possible to judge indirectly the oxidative phosphorylation of intestinal epithelium. Absorption of glycocol in the intestine depended on the oxidative phosphorylation in its epithelial cells. Wave-like or periodical disturbances of the processes of glycocol absorption were revealed after x-ray irradiation of animals (by 400 r). At the same time there was an inhibition of the oxidative phosphorylation in the intestinal epithelial cells. Addition of inorganic phosphate and adenosintriphosphate to the glycocol introduced into the intestine brought about pronounced increase of absorption of this substance. Thus, disturbance of the processes of glycocol absorption in irradiated animals depended on the depression of the oxidative phosphorylation in the intestinal epithelial cells. (tr-auth)

13674

THE SECRETORY FUNCTION OF THE INTESTINE IN RADIATION SICKNESS. M. F. Nesterin (Inst. of Dietetics, Academy of Medical Science, USSR). Med. Radiol. 3, 42-6(1958) May-June. (In Russian)

The activity of enterokinase in the secretory function of an isolated section of duodenum was studied. (R.V.J.)

13675

SECRETORY FUNCTION OF THE SMALL INTESTINE IN DOGS IN ACUTE RADIATION SICKNESS. K. V. Smirnov. Med. Radiol. 3, 46-51(1958) May-June. (In Russian)

The secretory function of the small intestine was studied in 25 dogs with isolated intestinal loop by Tiery's method. Intestinal juice was obtained by mechanical stimulation. The quantity of the juice recovered within 6 hours was measured. The activity of enterokinase, acid phosphatase, peptidase, and lipase was investigated. All dogs were irradiated by x rays in the dose of 400 r. The periods of increased fermentative activity of intestinal juice were observed, as well as the rise of the quantity of the juice. These periods were alternated with periods of normalization and depression. Excretion of intestinal ferments in the feces of dogs corresponded to the changes of activity of the ferments in the juice. Milk-egg and liver diets did not normalize the secretory processes of the small intestines in dogs. (tr-auth)

13676

ON DEVELOPMENT OF THE ACUTEST FORM OF RADIATION SICKNESS. L. F. Semenow (Central Research Inst. of Roentgen-Radiology, Leningrad). Med. Radiol. 3, 70-7(1958) May-June. (In Russian)

The acutest form of radiation does not appear in irradiation of the whole body with screening of the head and develops in isolated irradiation of the head alone. Action of radiation on the body in general irradiation causes an inhibiting effect on development of the acutest form of radiation sickness. Prophylactic use of anaesthesia is able to prevent the acutest form of radiation sickness and to change the process into the usual acute radiation sickness. Cysteinamine and thiourea are not effective in the referred to doses of radiation. It is suggested that in case of the acutest form of radiation sickness the mechanism of its development is predominantly central, while in case of acute form it is mostly reflex in character. (tr-auth)

13677

EFFECTS OF RADIOACTIVE STRONTIUM ON ORGANISMS. I. A. Pigalev. Med. Radiol. 3, 80-4(1958) May-June. (In Russian)

A review is given on the immediate and delayed effects of radioactive strontium. (R.V.J.)

13678

IMMUNE RESPONSES OF IRRADIATED ORGANISMS. N. N. Klemparskaya. Med. Radiol. 3, 85-90(1958) May-June. (In Russian)

The characteristics and nature of immune biological responses of irradiated organisms are reviewed. (R.V.J.)

13679

SOME PROBLEMS ON THE TOXICOLOGY OF RADIOACTIVE STRONTIUM. M. Kapuscinska. Nukleonika 3, 342-9(1958). (In Polish)

The hematological changes and effects of large doses of Sr^{89} and Sr^{90} on organisms are discussed. (R.V.J.)

13680

RADIATION AND THE SEX RATIO IN MAN. William J. Schull and James V. Neel (Univ. of Michigan, Ann Arbor). Science 128, 343-8(1958) Aug. 15.

Because of the difference in manifestation and distribution of sex-linked genes, it would be expected that a significant change would occur in the sex ratio if human populations were sufficiently exposed to mutagenic factors such as x rays or the fall-out from weapon testing. An analysis of new data concerning the sex of children born to the survivors of the atomic bombings of Hiroshima and Nagasaki reveals significant changes in the sex ratio of these children. (J.S.R.)

Radiation Hazards and Protection

Refer also to abstract 13647.

13681 AMRL-348
Army Medical Research Lab., Fort Knox, Ky.
ORGAN WEIGHT CHANGES IN GRID-SHIELDED X-IRRADIATED RATS. J. G. Kereiakes, W. H. Parr, and A. T. Krebs. July 28, 1958. 14p. Project No. 6-59-08-014.

The findings confirm the beneficial effect of partial shielding by grids on survival of x-irradiated rats. For rats receiving equal mid-line doses through grids of constant per cent open area, there is increased survival with decreasing grid aperture size. In addition a delay in the timely distribution of intestinal deaths was noted for smaller aperture size grids, although this delay was not reflected by intestinal weight changes. Small changes, significant in some instances, were observed in spleen, liver, and kidney weights. These changes did not appear to follow the increased survival pattern observed for rats irradiated through grids of decreasing aperture size. (auth)

13682 AF-SAM-58-91
School of Aviation Medicine, Randolph AFB, Tex.
THE BEHAVIOR OF THE RADIATION PROTECTIVE AGENT AET IN HUMAN SERUM IN VITRO. Bernard Shapiro. Mar. 20, 1958. 15p.

The behavior of 72-aminoethylisothiuronium bromide hydrobromide (AET) in human serum was studied by utilizing paper chromatography, paper electrophoresis, and S^{35}-labeled AET of high specific activity. On addition of crystalline S^{35} AET to serum, mercaptoethylguanidine (MEG), guanidinoethyl disulfide, and 2-aminothiazoline (2-AT) are formed and a large portion of radioactivity is bound to the protein. These forms are highly stable and do not change on standing or with irradiation, except in extraordinarily large doses. Addition to human serum of AET in buffered solution containing only MEG and guanidinoethyl disulfide gives the same results as with crystalline AET except that no 2-AT is found. These studies may indicate failure of the radical capture process by products of AET in serum. However, these results do not reveal the in vivo situation which may be completely different. (auth)

13683 LA-2224
Los Alamos Scientific Lab., N. Mex.
RATE OF RECOVERY FROM RADIATION DAMAGE AND ITS POSSIBLE RELATIONSHIP TO LIFE SHORTENING IN MICE. John B. Storer. May 1958. 45p. Contract W-7405-eng-36. $7.80(ph OTS); $3.30 (mf OTS).

Data from a number of published reports on the survival times of mice exposed to daily doses of radiation were examined and mean recovery rate constants for animals exposed to different numbers of doses were calculated. The mean rate at which mice recover from the radiation damage contributing to acute death can be related empirically to the number of daily radiation doses delivered. Recovery from neutron-induced damage is slower at all time intervals than recovery from x or gamma radiation damage. By using the empirically derived relationships and certain assumptions about the change in LD_{50} with age, it was possible to predict the general form of the relation between daily dose and shortening of life span. The application of the equations to the problem of increased sensitivity to further exposure following various regimens of small daily doses is discussed. A further consequence of the derived equations is that the relative lethal effectiveness of neutrons varies with the size of the daily exposure. An hypothesis relating recovery rate to life shortening in general is advanced. (auth)

13684 NP-6863
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
MEASUREMENTS OF RADIOACTIVE FALL-OUT IN WARSAW, POLAND, DURING THE YEAR 1957. Report No. 16/X doz. R. Szepke, Z. Gorberg, and E. Klimaszewska. Mar. 1958. 9p.

The measurements of the radioactivity of fall-out have been carried out by the Dosimetry Branch of the Health Protection Division since 1 August 1956. Originally only chance measurements were made but since 1 January, 1957 the work has been more systematic. From 1 September to 31 December 1957 sampling of rain water and dust was done every week, and since 1 January 1958 it is done every day. The sampling station is located between two one-story buildings on the site of the Institute for Nuclear Research in Warsaw-Żerań. The distance between the buildings is approx. 100 m. Żerań is situated 10 km. north of Warsaw, close to the Vistula river. (auth)

13685 UCRL-8024
California. Univ., Berkeley. Radiation Lab.
LOCALIZATION OF CERIUM-144 IN THE SKELETAL TISSUES OF FETAL RATS. C. Willet Asling, Muriel E. Johnston, Patricia W. Durbin, and Joseph G. Hamilton. Oct. 18, 1957. 28p. Contract W-7405-eng-48. $1.00 (OTS).

The developing fetal skeleton of the rat was used to study the microscopic localization of the rare earth Ce^{144} in bone. Nineteen-day-old rat fetuses were injected with Ce^{144} in isotonic sodium citrate via the umbilical vein. They were sacrificed one-half hour after the injection by immersion in 80% alcohol fixative. The fetuses were embedded in paraffin and sectioned at 10 to 12μ. Semiserial sections were treated with periodic acid-Schiff stain for mucopolysaccharides, and by the von Kossa technique for calcium. Contract x-ray-film autoradiographs and NTB stripping-film autoradiographs were prepared. Photographs of representative sections and their respective autoradiographs are presented for various bones. This material strongly suggests that the initial binding site of Ce^{144} in the skeleton is in the organic matrix of cartilage and bone, especially where this matrix is just entering the calcifiable state. This conclusion is highly dependent upon the specificity of the von Kossa stain for calcium. (auth)

13686 USNRDL-TR-137
Naval Radiological Defense Lab., San Francisco.
THE RELATIONSHIP OF TIME OF PEAK ACTIVITY FROM FALLOUT TO TIME OF ARRIVAL. P. D. LaRiviere. Feb. 28, 1957. 15p.

A mathematical formula is presented for use in establishing the relationship between the time of arrival,

time of peak intensity, and time of cessation of fall-out. A simple relationship was found between these parameters over a wide variety of conditions. (C.H.)

13687 USNRDL-TR-245

Naval Radiological Defense Lab., San Francisco.
PREVENTION OF LATE DEATHS IN X-IRRADIATED MICE BY INJECTED HEMATOPOIETIC CELLS OF NEWBORN DONORS. L. J. Cole. June 24, 1958. 20p.

When mice are exposed to a single sublethal dose of x radiation (500 r) and injected with normal spleen cells obtained from adult parental strain mice, delayed deaths during the 2nd, 3rd, and 4th weeks with symptoms of general debilitation, body weight loss, and lymphoid atrophy occur in 100% of the animals. Lethal effect is dependent in part on the size of the spleen cell inoculum. The lethal effect is not duplicated by the injection of lysed spleen cells, by liver cells, or by spleen cells derived from newborn parental strain mice. The injection of cells from liver, spleen, or marrow of newborn A-strain mice into lethally x-irradiated LAF_1 mice provides up to 100% protection at 30 days, and elicits no late homologous deaths. (auth)

13688 WADC-TR-57-118(Pt.I)

RCA Service Co., Inc., Camden, N. Y.
A RADIOBIOLOGY GUIDE. Robert E. Barbiere, Richard F. Sweeton, George P. Sakalosky, and Paul E. Klatt. June 1958. 120p. Contract AF33(616)-3665. (AD-118082).

Radiobiology pertinent to power and research applications of nuclear energy is discussed. The following topics are treated: nuclear physics, observed biological effects of radiation, shielding methods, monitoring instruments, medical evaluation of personnel, treatment of injuries, and permissible doses. (auth)

13689

DOSAGE AND BIOLOGICAL EFFECTS OF INTERNAL RADIOACTIVITY. J. N. Stannard (Univ. of Rochester, N. Y.). Arch. Ind. Health 18, 95-101(1958) Aug.

The hazards from internally deposited radioactive substances are reviewed. Factors to be considered in handling radioactive materials are reviewed. (C.H.)

13690

ADMINISTRATIVE PROBLEMS IN NUCLEAR ENERGY. Thomas L. Shipman (Los Alamos Scientific Lab., N. Mex.). Arch. Ind. Health 18, 106-9(1958) Aug.

Administrative problem associated with industrial applications of nuclear energy are reviewed. (C.H.)

13691

COMMON SENSE APPROACH TO THE PROBLEM OF GENETIC HAZARD DUE TO DIAGNOSTIC RADIOLOGY. W. Daggett Norwood (General Electric Co., Richland, Wash.). J. Am. Med. Assoc. 167, 1928-35(1958) Aug. 16.

The genetic hazards of radiation to whole populations are evaluated in the light of the most recently available data. The contributions of radiation used in medicine, industry, and defense are considered. The average genetically significant exposure limits established by various groups are discussed. The important contribution of diagnostic radiology in lengthening the life span of man is emphasized. 31 references. (C.H.)

13692

ON CONTENTS OF K^{40} IN THE URBAN SEWAGE. L. B. Dolivo-Dobrovolskii and F. S. Zavelskii (Erisman Moscow Research Inst. of Sanitation and Hygiene). Med. Radiol. 3, 65-8(1958) May-June. (In Russian)

It was estimated that every urban inhabitant excretes about 300 μg of K^{40} the activity of which is about 2×10^{-9} c. The K^{40} was determined in the urban sewage. It was found that radioactivity of sewage from the residential districts equalled 6×10^{-12} c per litre, from the industrial 1.7×10^{-11} c per litre, and mixed 2.3×10^{-11} c per litre. Comparison of these numbers allows the determination of radioactivity of urban sewage (K^{40}) due to the natural processes (the natural background) and radioactivity appearing as a result of industrial activity of man (pollution). (tr-auth)

13693

THE STRUCTURE AND PROTECTIVE ACTION OF CHEMICAL SUBSTANCES USED IN PROTECTION AGAINST THE ACTION OF IONIZING RADIATION. Antoni M. Dancewicz (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Nukleonika 3, 313-28(1958). (In Polish)

The protective action of different chemical substances against ionizing radiations is described. The correlation between chemical structure and protection effect is discussed. It is pointed out that the substances, which protect mammals could be considered as belonging to one group of compounds of defined structure. The role of protective action of anoxia, competition by free radical removal and the substitution of sulfhydryl substances easily inactivated by irradiation, which are most important for living organism is considered as possible modes of action in the mechanism of radiation protection by chemicals protectors. (tr-auth)

13694

THE ACCUMULATION OF CERIUM RADIOISOTOPES BY FRESH WATER MOLLUSKS. G. G. Polikarpov (Sebastopol Biological Station, Academy of Sciences, USSR). Priroda No. 5, 86-7(1958) May. (In Russian)

Concentration of Ce^{144} in Bithynia leachi mollusks is discussed. (R.V.J.)

Radiation Sickness

13695

THE EFFECT OF CYSTEINAMINE ON THE CHEMORECEPTION OF THE CAROTID GANGLION. G. I. Smorodintseva (Central Research Inst. of Roentgen-Radiology, Ministry of Health, USSR). Med. Radiol. 3, 15-21(1958) May-June. (In Russian)

Administration of cysteinamine in combination with the chemical substances, which are the typical stimulants of the carotid zone (such as cytisin, sodium cyanide), brings about a certain increase of its protective effect in radiation sickness. (tr-auth)

Radiotherapy

13696

PHYSICAL MEASUREMENTS ON THE LONDON HOSPITAL PICKER C 3000 COBALT UNIT. L. A. W. Kemp and J. E. Burns (London Hospital). Acta Radiol. 49, 471-84(1958) June.

Physical measurements on the Picker C 3000 cobalt unit installed at The London Hospital, England, are reported. The strength of the source at installation (May 1956) was approximately 1,500 curies. The measurements include accurate assessment of room protection, backscatter factors, build-up in the superficial layers, leading to the computation of over-all field factors relating the standard output in air to the dose rate in rads/min at the '100' level for any given field. Central axis percentage depth doses were in good general agreement with those of Johns. Ex-

tensive study of the effects of field elongation on depth doses showed excellent agreement with the data of Jones and of Day. (auth)

13697

THE APPLICATION OF Co^{60} AND Cs^{137} TO TELECURIE THERAPY. J. H. Mellink (Akademischen Krankenhauses in Leiden). Atompraxis 4, 211-27(1958) June. (In German)

The suitability of Co^{60} and Cs^{137} as telecurie sources is discussed. Their advantages and disadvantages are compared. The calculation of the dose rate of gamma radiation from the level scheme of the radioactive nucleus is described. The protective shielding necessary in the use of Co^{60} and Cs^{137} is reviewed. (J.S.R.)

13698

A TAPLESS INFUSION APPARATUS FOR RADIO GOLD TREATMENT. F. Hawliczek (Krankenhauses der Stadt, Vienna-Lainz, Austria). Atompraxis 4, 228-9(1958) June. (In German)

An infusion apparatus is described for intracavitary radiogold treatment which is characterized by especially good radiation protection and easy sterilization. The latter is achieved by doing away entirely with ordinary taps and using specially constructed squeezetaps instead. The apparatus is particularly easy to use because sterile conditions are not necessary. The radiation exposure of the personnel is extremely slight, amounting to approximately 2 to 3 milliroentgens per treatment with 100 millicuries of radioactive gold. (auth)

Toxicology Studies

13699

HAEMORRHAGIC SYNDROME IN THE CLINICAL PICTURE OF RADIATION SICKNESS IN DOGS AFFECTED BY POLONIUM. S. M. Mikhailovich. Med. Radiol. 3, 9-14(1958) May-June. (In Russian)

Subcutaneous introduction of polonium to dogs brings about development of radiation sickness with appearance of haemorrhagic syndrome, which is characterized by disturbed process of blood coagulation, thrombocytopenia, decreased prothrombin value of the blood, increased permeability of capillaries. The clinical picture of the usually developed affection corresponds to the well known symptomatology, described in literature. Indicators of the haemorrhagic syndrome (blood coagulation, prothrombin value, permeability and stability of capillaries) appear in animals earlier than the clinical manifestations of this syndrome. (tr-auth)

13700

THE EFFECT OF RADIOACTIVE PHOSPHORUS ON THE OXIDATIVE PROCESSES OF THE ORGANISM. V. V. Rudakov (Kirov Military-Medical Academy). Med. Radiol. 3, 21-5(1958) May-June. (In Russian)

Radioactive phosphorus in doses of 1.1 to 1.3 mc per kg of body weight was introduced per os to cats during the absence of manifestations of the radiation syndrome. There was a certain increase in absorption of oxygen in the liver, mucous membrane of the stomach, and small intestine, as well as in the brain. Radioactive phosphorus in doses of 3.0 to 3.3 mc per kg of body weight introduced at the time of pronounced manifestations of the radiation sickness causes decrease of absorption of oxygen in the liver, mucous membrane of the stomach, and small intestine. Absorption of oxygen by various portions of the brain is not changed. There is a decrease in the activity of succindehydrase during actue radiation sickness (in the liver and mucous membrane of the stomach) and of cytochromoxydase (in the liver, mucous membrane, and intestine). However, the activity of these ferments in various portions of the brain remains unchanged. In radiation sickness caused by introduction of radioactive phosphorus there is a decrease in intensity of phosphorylation in the cerebral cortex, mucous membrane of the stomach, and intestine connected with oxidation. (tr-auth)

Tracer Applications

Refer also to abstract 13647.

13701 TID-3513

Technical Information Service Extension, AEC. ISOTOPES IN BIOCHEMISTRY AND BIOSYNTHESIS OF LABELED COMPOUNDS. A Selected List of References. J. A. McCormick, comp. Mar. 1958. 89p. $2.25(OTS).

This bibliography contains 2430 selected references on uses of radioisotopes in biochemistry and biosynthesis of labeled compounds. These references were taken from the 1948 to 1956 open literature. A list of the journals from which the references were selected and an author index are also included. (auth)

13702 UR-524

Rochester, N. Y. Univ. Atomic Energy Project. AMOUNT OF PLASMA PROTEINS AND RED BLOOD CELLS AND THE VASCULAR-EXTRAVASCULAR EXCHANGE OF PLASMA PROTEINS IN THE RAT AS MEASURED WITH I^{131} AND Cr^{51} LABELS. William C. Dewey. June 1, 1958. 379p. Contract W-7401-eng-49. $61.30(ph OTS); $11.10(mf OTS).

A study was made of the vascular-extravascular exchange of homologous and heterologous plasma proteins in the individual tissues of the rat. The rate at which tissue specific antibodies localize in specific interstitial spaces was also investigated. Injected red blood cells labeled with chromium-51 and plasma proteins labeled with iodine-131 were used as tracers. (C.H.)

13703

AN ANALYSIS OF TECHNICAL ERRORS IN RADIOALBUMIN BLOOD VOLUME METHODS AND PRESENTATION OF A MODIFIED METHOD. Charles J. Hlad, Jr. and Rose Tanz (General Rose Memorial Hospital and Veterans Administration Hospital, Denver). J. Lab. Clin. Med. 52, 289-98(1958) Aug.

A modified technique for measuring blood and plasma volume with labeled serum albumin (RISA) has been presented. The technical errors of this technique have been evaluated and minimized. Data on 50 normal men living at an altitude of 1 mile are given. It is concluded that the modified method has a low degree of technical error and it is suitable for routine clinical use. (auth)

13704

BIOLOGICAL ISOTOPE TRACER LABORATORIES IN CZECKOSLOVAKIA. Jan Doroszewski. Nukleonika 3, 335-41(1958). (In Polish)

Descriptions are given of the laboratory equipment, tracer techniques, and biological isotope tracer applications in Czechoslovakia. (R.V.J.)

CHEMISTRY

Refer also to abstracts 13701, 14389, 14405, 14421, and 14432.

13705 AECU-3788

Michigan. Univ., Ann Arbor. CORRELATION OF POLAROGRAPHIC WALF-WAVE

POTENTIALS WITH NUCLEAR MAGNETIC RESONANCE "CHEMICAL SHIFTS." PARALLEL CORRELATION WITH CHEMICAL REACTIVITY PARAMETERS. Report No. 35. C. Eugene Bennett and Philip J. Elving. July 14, 1958. 29p. Project No. 8. Contract AT(11-1)-70. $4.80(ph OTS); $2.70(mf OTS).

Since nuclear magnetic resonance "chemical shifts" are considered to be good measures of electron densities in molecules, the extent to which they can be correlated with the polarographic half-wave potentials of organic compounds has been surveyed. To extend the applicability and interpretation of the proposed correlation, parallel correlations of $E_{1/2}$ with Hammett's σ and Taft's σ parameters were made, since both of the latter are also regarded as indication of electronic distribution at the reactive center. The data in general support the view that changes in half-wave potential with structure are due to both electronic and steric effects, as well as perhaps to adsorption phenomena. Significantly, NMR data obtained with one type of substituent could be correlated with $E_{1/2}$ data for a similar type of substituent. New NMR data for aliphatic nitro and halogen compounds are reported. (auth)

13706 AECU-3789
Anderson Physical Lab., Champaign, Ill.
PROGRESS REPORT [FOR] JULY 1958. Technical Report No. 3. 24p. Contract AT(11-1)-544. $4.80(ph OTS); $2.70(mf OTS).

Work towards the preparation of pure alkali halides is described. It was found that zone refining is an effective technique for the refinement of KCl. Four zone passed through one specimen of Harshaw KCl decreased its low-temperature conductivity by a factor of six. Kyropulos apparatus has been constructed to grow large single crystals in controlled atmospheres. It operates satisfactory in ambient atmospheres, but because of the high volatility of KCl at its melting point the viewing windows cannot be kept clear and large crystals have not been grown successfully in a controlled atmosphere. Only the simplest methods were used in attempting to prevent the deposition of KCl on the viewing and illuminating ports. In all other respects, the crystal growing apparatus is satisfactory. The last section of the report discusses the efforts made towards developing procedures of quantitative chemical analyses of the salts. Most effort has been directed at spectrochemical methods. The cathode layer technique was used to attain improved sensitivity but as yet a routine quantitative procedure has not been developed. A hollow cathode technique may improve both sensitivity and accuracy and work is being done along with the cathode layer method. (auth)

13707 ISC-976
Ames Lab., Ames, Iowa.
SEMI-ANNUAL SUMMARY RESEARCH REPORT IN CHEMISTRY FOR JULY–DECEMBER 1957. Mar. 15, 1958. 67p. Contract W-7405-eng-82. $1.75(OTS).

Physical and Inorganic Chemistry. Research and development were continued on the six-inch and four-inch series of ion-exchange columns, and nearly ideal conditions were determined for use in resolving Lu, Yb, Tm, Er, and Ho mixtures after a preliminary separation from Y and light rare earths with ethylenediaminetetraacetic acid (EDTA). An ion-exchange process for separating Y, Mg, and Ca is being investigated. The work on the heat capacity of Lu has been completed. Magnetic moment studies of Er metal were completed. Work on the heat capacity of Tb is presented. Results of alloy studies of Y with some common metals are presented. Pyrometallurgy. A study of the separation of fission products from U by the process of pouring the molten fuel through a packed column of graphite or refractory oxide is presented. Analytical Chemistry. An investigation was started for a suitable analytical method for the determination of HF in the atmosphere. A procedure for the determination of oxygen in metals and metal fluorides is presented. Spectrochemistry. The emission spectrometric techniques for the determination of O_2 in metals have been extended to the determination of O_2 in Zr and Y metal. A flame spectrometric method for the determination of La in all combinations of rare earth mixtures has been developed. Radiochemistry. The isotope Sb^{127} is produced in fission and has been studied as one of the fission products of U. Study of the recoil chemistry of carbon in organic compounds as initiated by the $C^{12}(\gamma,n)C^{11}$ reaction, followed by separation of the compounds by gas chromatography, was continued. X-Ray Chemistry. The influence of the crystal versus the local field in determining the structure of complex ions of transition metals has been studied. (For preceding period see ISC-902.) (W.L.H.)

13708 LA-378(Del.)
[Los Alamos Scientific Lab., N. Mex.]
DEPOSITION OF NICKEL COATINGS ON METAL SURFACES BY DECOMPOSITION OF NICKEL CARBONYL. D. Lipkin, M. L. Perlman, S. I. Weissman, G. D. Dorough, and W. Spindel. Aug. 30, 1945. Decl. with deletions Feb. 27, 1957. 5p. Contract [W-7405-eng-36]. $1.80(ph OTS); $1.80(mf OTS).

A description of the deposition of nickel coatings on metal surfaces of complex shapes by heating the metal object in an atmosphere of nickel carbonyl is given. (auth)

13709 WADC-TR-57-455(Pt.II)
Midwest Research Inst., Kansas City, Mo.
HIGH TEMPERATURE SOLID DRY FILM LUBRICANTS. [Period Covered] April 1, 1957 to December 31, 1957. Melvin T. Lavik. Apr. 1958. 111p. Project Nos. 7331 and 3044. Contract AF33(616)-3684.

Solid dry film lubricants appear to be the answer for many high temperature lubrication problems. However, the wear-life of these films is dependent upon a large number of factors which complicate the choice of a particular lubricant film and its proper application. This report describes three phases of work directed toward the development of high temperature solid dry film lubricants. Parametric study of wear-life factors: The fractional factorial design of experiments (total of five) is used to evaluate the effect of ten factors upon the wear-life of several solid film lubricants. The factors studied are environmental temperature, bearing load, substrate hardness, film thickness, relative linear surface speed, lubricant material, film binder, lubricant-to-binder ratio, type of motion, and geometry of rub shoe. In the range of values investigated, the temperature (400 to 550°F) and the load (10,000 to 65,000 psi) had the greatest effect upon the wear-life of the lubricant films. Although the results are limited, a procedure is developed for evaluating a lubricant (for a particular application) with a minimum number of tests. Nuclear radiation effects: Four commercial solid dry film lubricants were submitted to gamma and neutron irradiation. Three of the films were resin-bonded mixtures of graphite and molybdenum disulfide. The other film was a mixture of lead oxide and graphite bonded with a glass-like material. Only the gamma irradiated specimens have been tested. The wear-life of one lubricant film is possibly affected by gamma irradiation; the others

showed no significant effect. Search for high temperature lubricants: A group of 16 inorganic materials have been selected for further investigation as possible high temperature (800°F) lubricants. This selection was made on the basis of a literature survey and the present knowledge of lubrication mechanisms. These materials are simple compounds and are mostly sulfides, oxides and chlorides of metals occurring in periods 3, 4, or 6 of the periodic table. (auth)

13710 WAPD-CDA(AD)-48

Westinghouse Electric Corp. [Bettis Plant], Pittsburgh. DECONTAMINATION OF THE WAPD-29 LOOP. R. Lloyd and W. T. Lindsay, Jr. [Sept. 1957]. 33p. $6.30(ph OTS); $3.00(mf OTS).

A summary of the chemical decontamination of the WAPD-29 loop at MTR is presented. The decontamination procedure includes the use of an oxidizing-complexing solution to remove UO_2 and fission products, followed by a reducing-complexing solution to remove crud and associated acitivities. The over-all decontamination factor was about 50. After decontamination, stainless steel welds were examined for deleterious or corrosive effects of decontamination, and none were found. (J.R.D.)

13711 WCRT-TM-56-143

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio. INVESTIGATION OF RUBBER COMPOUNDS FOR USE IN RADIATION RESISTANT ENGINE OILS. W. R. Griffin. Nov. 29, 1956. 4p. Project No. 73071.

A study was made of the effect of radiation-resistant engine oils on the physical properties of elastomers. (auth)

13712 AEC-tr-2718

HEAT CAPACITY AND ENTROPY OF SODIUM SUCCINATE. I. I. Strelkov, V. E. Ganenko, and A. V. Alapina. Translated by Lydia Venters (Argonne National Lab.) from Ukrain. Khim. Zhur. 21, 291-5 (1955). 8p.

The entropy of the anhydrous salt of succinic acid under standard conditions was determined from the thermal dependence of the heat capacity at low temperatures. A detailed description of materials, methods, and apparatus used is presented along with tables summarizing the experimental results. (J.R.D.)

13713 AEC-tr-3317

INVESTIGATION OF THE MELTING POINT DIAGRAM OF THE BORON–CARBON SYSTEM AND NATURE OF PHASES IN THIS SYSTEM. G. A. Meerson and G. V. Samsonov. Translated by Lydia Venters for Argonne National Lab. from Izvest. Sektora Fiz.-Khim. Anal., Inst. Obshchei Neorg. Khim., Akad. Nauk S.S.S.R. 22, 92-103(1953). 17p.

Investigation of the melting point diagram of the system boron-carbon in the region from 10 to 50 weight % C has been carried out. A metallographic investigation method for the alloys in the system boron-carbon, which distinguishes itself by an extremely high hardness and do not submit to the etching by the usual reagents, has been worked out. It has been shown that in the regions investigated boron forms with carbon the chemical composition B_4C, which dissociates in melting and develops in accordance with the peritectic reaction B + liquid $\rightleftharpoons$ B_4C at 2250°. The existence of the eutectic B_4C with carbon with 30.2% C and with the melting point at 2150° has been established; preliminary solidus lines of the system are plotted. The microhardness of boron and boron carbide is measured, which amounts from 3440 to 5000 Kg/mm^2. (auth)

13714 AEC-tr-3326

CHEMICAL EQUILIBRIA OF REACTIONS BETWEEN HYDROCARBONS. ARTICLE 2. CONSTANT OF EQUILIBRIUM OF REACTION $2C_6H_6$ GOES REVERSIBLY INTO $C_6H_5C_6H_5$ PLUS H_2. A. A. Vvedenskii and A. V. Frost. Translated for Atomics International from Zhur. Obshchei Khim. 2, 542-52(1932). 18p.

The constants of equilibrium of the reaction $2C_6H_6$ goes reversibly into $C_6H_5C_6H_5$ plus H_2 have been determined at temperatures 845, 900, and 920°C with an average error of plus or minus 0.14 in the value of log K_p. Log K_p of the reaction has been calculated in the temperature interval 300 to 950° according to the experimental data and the data calculated according to the third law of thermodynamics. It has been found for the reaction that the approximate formula of Nernst gives very imprecise results, the deviation reaching 1.0 in the value of log K_p. The reaction $C_6H_5C_6H_5$ plus C_6H_6 goes reversibly into $C_6H_5C_6H_4C_6H_5$ plus H_2 at temperature 845 to 920°C. On the basis of the data it is shown that the process of condensation at the temperature of cracking (400 to 500°C) proceeds in the absence of H_2. (auth)

13715 TT-749

THE STATE OF AGGREGATION OF LUMINESCENT ORGANIC COMPOUNDS IN POLYSTYRENES. (Ob Agregatnom Sostoiannii Liuminestsiruiushchikh Organicheskikh Soiedinenii v Polistirole.) I. E. Pani, E. E. Baroni, and V. M. Shoniia. Translated by D. A. Sinclair (National Research Council of Canada) from Zhur. Fiz. Khim. 31, 732-3(1957). 8p.

The results obtained during investigations of scintillators in a polystyrene base prepared by thermal polymerization without the use of catalysts are presented. Complete polymerization of styrene with 1 to 3% luminescent substance was attained in a period of 10 hours at 200°C in sealed ampules filled with nitrogen. Experiments are described for determining whether the state of aggregation of the luminescent substance in the finished plastic depends essentially on its chemical structure. It is assumed that the luminescent substances are distributed in the polystyrene in the form of microcrystals or form labile molecular compounds. (J.R.D.)

13716

ON ION EXCHANGE EQUILIBRIA. V. AN APPROXIMATE METHOD FOR CALCULATING THE PARTIAL MOLAR VOLUMES OF THE SPECIES IN ION EXCHANGERS. Erik Högfeldt (Brookhaven National Lab., Upton, N. Y.). Acta Chem. Scand. 12, 182-7(1958).

By formally regarding an ion exchange system as a binary mixture of the two resin forms, partial molar volumes can be determined using the intercept method of Roozeboom. This method was applied to the potassium-tetramethylammonium exchange on resins with DVB content 2, 10, and 26%, reported by Gregor, Gutoff, and Bregman. It is surprising to find that, to a first approximation all three systems have an ideal volume of mixing over the large range of variation, 1.3 to 18, in total molality of the resin. (auth)

13717

MICROHARDNESS OF ALUMINUM BORIDE MONOCRYSTALS. Perry G. Cotter (Bureau of Mines, Norris, Tenn.). Am. Mineralogist 43, 781-4(1958) July-Aug.

13718

COMPLEXES OF VANADIUM (IV). X. THE VANADIUM (IV)–MALONATE SYSTEM. R. Trujillo and F. Torres (Uviversidad de La Laguna). Anales real soc. espan. fis. y quim. (Madrid) Ser. B. 54, 377-82 (1958) May. (In Spanish)

The complex formation of V^{4+} with malonic acid was studied using a solution containing $VO(ClO_4)_2$, the metallic Vion, and malonic acid. The absorption spectrum was obtained. The formula for the complex, obtained by the method of Job and from molar relations, was determined to be $[VO-(Mal)-VO]^{2+}$. (J.S.R.)

13719

HEMICOLLOIDAL MINERALS. II. Jacques Duclaux and Charlotte Cohn (Institut de Biologie physicochimique, Paris). Bull. soc. chim. France No. 5, 657-60(1958) May. (In French)

A method is proposed for the preparation of hemicolloidal minerals. It depends on partition between water and an organic liquid. The colloidal part remains wholly in the aqueous layer while the small molecules distribute between the two. The hydroxides of Th and Zr, prepared by this method or one previously described, show to a great degree the characteristic properties of hemicolloids; high stability, osmotic pressure elevation, and most important of all an exceptionally high solubility. Hemicolloidal solutions with the same characteristics can form just as well in organic solvents such as amyl alcohol. (auth)

13720

ELECTROLYSIS OF THE OXIDES OF NICKEL, COBALT, AND IRON IN A FUSED MIXTURE WITH A BASE OF POTASSIUM FLUOBORATE. S. Aléonard. Bull. soc. chim. France No. 6, 827-9(1958) June. (In French)

If the oxides NiO, CoO, and Fe_2O_3 are dissolved in a fused mixture of potassium fluoride and potassium fluoborate, all the metal deposited in a primary phase in the form of crystalline fines is borided in proportion to the subsequent deposition of boron. The borides of all three metals can be obtained in this manner. (tr-auth)

13721

CONTRIBUTION TO THE STUDY OF THE COMPLEXES OF THE CITRATES AND TARTRATES. IV. THE COMPLEX OF VANADIUM WITH CITRATE. Clara Heitner-Wirguin and Débora Friedman (L'Université Hébraïque, Jérusalem). Bull. soc. chim. France No. 7, 970-3(1958) July. (In French)

The existence of a stable complex $(VOCl)^{2-}$ was shown by means of pH and spectrophotometric measurements. The possible existence of a 2VO/Cl complex is discussed. (tr-auth)

13722

THE STABILITY AND MANNER OF DECOMPOSITION OF CUBIC SOLID SOLUTIONS OF ZIRCONIUM OXIDE. Robert Collongues and Jochen Stöcker. Compt. rend. 246, 3641-4(1958) June 30. (In French)

It is shown that the cubic solid solutions ZrO_2-MO and $ZrO_2-M_2O_3$ (in which M stands for Mg, Fe, Ni, Zn, Cd, Al, or Cr) have stable phases at high temperatures and that their decomposition at room temperature is a reaction of the eutectoid type. (J.S.R.)

13723

EQUILIBRIUM POTENTIALS OF ZIRCONIUM IN CHLORIDE MELTS. M. V. Smirnov and V. A. Chemezov (Electrochemical Lab., Urals Branch of the Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 120, 122-5(1958) May 1. (In Russian)

The dependence of the equilibrium potential of zirconium on temperature and ion concentration in chloride melts was investigated. (R.V.J.)

13724

THE VAPORIZATION OF MOLYBDENUM AND TUNGSTEN OXIDES. Paul E. Blackburn, Michael Hoch, and Herrick L. Johnston (Ohio State Univ., Columbus). J. Phys. Chem. 62, 769-73(1958) July.

The vapor pressures above MoO_3, Mo_4O_{11}, MoO_2, WO_3, and WO_2 were measured by the Knudsen effusion method. $MoO_3(s)$ vaporizes to $(MoO_3)_3(g)$ while $Mo_4O_{11}(s)$ disproportionates to $(MoO_3)_3(g)$ and $MoO_2(s)$, the heats of vaporization of $MoO_3(s)$ and of decomposition of $Mo_4O_{11}(s)$ being $\Delta H_{900} = 79.7$ kcal/mole of $(MoO_3)_3$ and $\Delta H_{900} = 68.7$ kcal/mole of $(MoO_3)_3$, respectively. Some $MoO_2(s)$ vaporizes to $MoO_2(g)$ with $\Delta H_0^0 = 129.8$ kcal/mole, but most of the $MoO_2(s)$ disproportionates to $MoO_3(g)$ and Mo(s) with $\Delta H_0^0 = 133.6$ kcal/mole of MoO_3. $WO_3(s)$ vaporizes to $(WO_3)_3(g)$ with $\Delta H_{1500} = 108.0$ kcal/mole of $(WO_3)_3$ and $WO_2(s)$ disproportionates to $(WO_3)_3(g)$ and W(s) with $\Delta H_{1500} = 90.2$ kcal/mole of $(WO_3)_3$. The calculated heat of dissociation for $MoO_2(g)$ is $D_0^0 = 284.6$ kcal/mole and for $MoO_3(g)$ is $D_0^0 = 410.3$ kcal/mole. The heat of decomposition of $(MoO_3)_3(g)$ to the monomer $MoO_3(g)$ is $\Delta H = 220.9$ kcal/mole of the trimer. (auth)

13725

CRYOSCOPY OF THE LiCl–KCl EUTECTIC MELT CONTAINING ALKALI HALIDES AND ALKALI TITANIUM FLUORIDES AS SOLUTES. G. J. Janz, C. Solomons, H. J. Gardner, J. Goodkin, and C. T. Brown (Rensselaer Polytechnic Inst., Troy, N. Y.). J. Phys. Chem. 62, 823-6(1958) July.

The cryoscopic behavior of NaCl, LiF, NaF, KF, Li_2TiF_6, Na_2TiF_6, and K_2TiF_6 in the LiCl–KCl eutectic melt is reported. In the regions of dilute concentrations, the behavior of the alkali halides is in accord with complete dissociation, the deviations from thermodynamic ideality being attributed to solid solution formation, and for LiF, in addition, an activity coefficient of 2. The cryoscopy of the alkali titanium fluorides similarly is in accord with a primary dissociation to form the alkali fluoride and titanium tetrafluoride in the melt. The results are discussed in the light of the various theories and models of ionic mixtures. (auth)

13726

VOLUME EFFECTS ON MIXING IN THE LIQUID Bi–$BiCl_3$ SYSTEM. F. J. Keneshea, Jr. and Daniel Cubicciotti (Stanford Research Inst., Menlo Park, Calif.). J. Phys. Chem. 62, 843-7(1958) July.

Volume effects upon mixing in the liquid Bi–$BiCl_3$ system were determined by measuring the density as a function of temperature for various mixtures. A pycnometric method was used for the density measurements. There is a decrease in the total volume of the system on mixing. In the salt-rich mixtures the partial molar volume of $BiCl_3$ is approximately the same as the molar volume, and increases with increasing temperature; the partial molar volume of bismuth is much less than the molar volume and decreases with increasing temperature. In the metal-rich mixtures the partial molar volume of $BiCl_3$ is much less than the molar volume, and the partial molar volume of bismuth is about the same as the molar volume. These effects are interpreted in terms of an interstitial type of solution; in the salt-rich solutions, for example, the added bismuth atoms or ions are pictured as entering into the octahedral holes in the chloride quasi-lattice. It also was found that the expansivity of the salt-rich solutions exhibits negative deviations from additivity, which is found to be due to the negative expansivity of the bismuth in solution. Such behavior is in accord with the proposed solution mechanism. (auth)

13727

SOLUBILITY OF NOBLE GASES IN MOLTEN FLUORIDES. I. IN MIXTURES OF $NaF-ZrF_4$ (53–47 MOLE %) AND $NaF-ZrF_4-UF_4$ (50–46–4 MOLE %).

W. R. Grimes, N. V. Smith, and G. M. Watson (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 62, 862-6(1958) July.

Solubilities of He, Ne, Ar, and Xe were determined at pressures from 0.5 to 2 atmospheres in $NaF-ZrF_4$ (53–47 mole %) at 600, 700, and 800°. The solubilities increase linearly with gas pressure, decrease with increasing atomic weight of the solute and increase with increasing temperature. Henry's law constants in moles of solute/(cm^3 solution)(atmosphere) at 600° are $21.6 \pm 1 \times 10^{-6}$, $11.3 \pm 0.3 \times 10^{-6}$, $5.06 \pm 0.15 \times 10^{-6}$, and $1.94 \pm 0.2 \times 10^{-6}$ while heats of solution are 6.2, 7.8, 8.2, and 11.1 kcal/mole for He, Ne, Ar, and Xe, respectively. Solubilities and heats of solution for He and Xe in $NaF-ZrF_4-UF_4$ (50–46–4 mole %) are very similar to the values obtained with these gases in the $NaF-ZrF_4$ mixture. (auth)

13728

EQUILIBRIUM BETWEEN CERIUM AND SULFUR IN LIQUID IRON. F. C. Langenberg (Crucible Steel Co. of America, Pittsburgh) and J. Chipman (Massachusetts Inst. of Tech., Cambridge). Trans. Met. Soc. AIME 212, 290-3(1958) June.

Equilibrium in the reaction CeS (solid or in slag) = Ce(in Fe) + S(in Fe) was studied by melting under a neutral atmosphere in pure CeS, Al_2O_3, and MgO crucibles and adding cerium or sulfur. The results show the strong desulfurizing power of cerium. The product [pct Ce] [pct S] was found to be 1.5×10^{-3} at 1600°C. (auth)

13729

THE STATE OF MICRO-QUANTITIES OF RADIOACTIVE ELEMENTS IN BOTH LIQUID AND SOLID PHASE. I. E. Starik. Zhur. Neorg. Khim. 3, 6-15(1958). (In Russian)

The experimental difficulties in the determination of the form (colloid or ion) in which microquantities of radioelements are present in solutions are discussed. An investigation was made of the adsorption and desorption of Po, using glass. The deposition of Po on copper was also studied at pH values from 1 to 13. Data on the solubility of the hydroxides of Po, Ru, Tl, Zr, Pm, and La were compared with data from the literature. The adsorptive and colloidal properties of the radioelements were discussed as a function of pH. (J.S.R.)

13730

THE PROBLEM OF BEHAVIOR OF NATURAL RADIOACTIVE ISOTOPES. V. I. Baranov, A. M. Babeshkin, and K. B. Zaborenko. Zhur. Neorg. Khim. 3, 16-19 (1958). (In Russian)

In an investigation of the migration mechanism of radioactive elements in nature, the case in which the elements Ra and Th are crystal forming was studied. In the experimental work, Ba was used as the carrier as its crystal lattice is isomorphous with the lattice of Ra compounds. As the crystal lattice of Th is different, its migration mechanism must be considered on the basis of its chemical characteristics. The experimental data are in good agreement with Starik's theory (Geokhimiya 1, 17(1956)). (J.S.R.)

13731

THE CHEMICAL STATE OF RADIOPHOSPHORUS-32 FORMED IN SOME TARGETS WITH NEUTRON IRRADIATION. I. A. Korshunov and A. I. Shafiev. Zhur. Neorg. Khim. 3, 95-9(1958). (In Russian)

A study was made to determine the chemical state of phosphorus formed by the neutron irradiation of various targets. The principal target studied was CCl_4. The valence states of phosphorus, its adsorption on the walls of the target flask, effect of contaminants, and the effect of radiation duration were investigated. Other targets used included S_2Cl_2, $CHCl_3$, Na_2SO_4, Na_2SO_3, $Na_2S_2O_3$, KCNS, NH_4Cl, $MgCl_2$, and $CaCl_2$. (J.S.R.)

13732

APPLICATION OF THE RADIOAUTOGRAPHIC METHOD FOR THE CONTROL OF RADIOCHEMICAL PURITY OF α-RADIOACTIVE SUBSTANCES. V. I. Baranov, K. B. Zaborenko, and V. I. Korobkov. Zhur. Neorg. Khim. 3, 184-6(1958). (In Russian)

The present applications of autoradiography in the purity control of alpha emitters are discussed, and its advantages are emphasized. The use of this method for the control of Th^{230} was described as an example. (J.S.R.)

13733

ON THE IMPORTANCE OF COMPLEX COMPOUNDS FOR RADIOCHEMISTRY. A. A. Grinberg. Zhur. Neorg. Khim. 3, 195-203(1958). (In Russian)

A review is presented of the importance of complex compounds in radiochemistry. The state of radioisotopes in solution is discussed, and coprecipitation and complex formation are described. Formation of complexes and extraction processes are reviewed. In the final section, a discussion of desorption is given. 30 references. (J.S.R.)

13734

APPLICATION OF ION EXCHANGE IN THE STUDY OF THE STATE OF SUBSTANCES IN SOLUTION. V. INVESTIGATION ON THE PROCESS OF THE FORMATION OF COMPLEXES OF ZIRCONIUM WITH NITRIC ACID. V. I. Paramonova and A. N. Sergeev. Zhur. Neorg. Khim. 3, 215-21(1958). (In Russian)

Zirconium in nitric acid solution forms complexes both by hydrolysis and nitration. Conditions for the hydrolysis of Zr were determined, and the formation of nitrate complexes were studied by means of ion exchange. (J.S.R.)

13735

REACTIONS OF TITANIUM WITH ELEMENTS OF PERIODIC SYSTEM. I. I. Kornilov. Zhur. Neorg. Khim. 3, 360-5(1958) Feb. (In Russian)

Chemical interactions of titanium were divided into four groups: the elements which do not react with titanium, such as Ba, Ca, Cs, Fr, K, Li, Mg, Na, Ra, Rb, and Sr, and inert gases Ar, Kr, Ne, Rn and Xe; the elements which form chemical complexes with ionic and covalent bonds, such as At, Br, Cl, F, I, O, Po, S, Se, and Te; the elements which form metallic bond complexes and limited solid solutions, such as Ag, Al, As, Au, B, Be, Bi, C, Cd, Co, Cu, Fe, Ga, Ge, H, Hg, In, Ir, Mn, N, Ni, Os, P, Pb, Pd, Pt, Re, Rh, Ru, Sb, Si, Sn, Tc, Tl, W, and Zr; and the elements which form continuous solid solutions in β phase, such as Cr, Hf, Mo, Nb, Sc, Ta, V, U, and Zr. (R.V.J.)

13736

PREPARATION OF ZIRCONIUM HYDROXIDE. I. V. Tananev and M. Ya. Bokmel'der. Zhur. Neorg. Khim. 3, 1273-80(1958) June. (In Russian)

The solubility method, pH measurements, electric conductivity, and visual precipitation methods were used in studies of the formation of zirconium hydroxide in the reaction of zirconium sulfate and oxychloride dilute solutions with nitric acid. Three stages were observed in the reaction of zirconium sulfate with alkali: first the basic salt $3Zr(SO_4)_2 \cdot Zr(OH)_4$ forms, then the basic salt $(ZrO \cdot OH)SO_4$ precipitates, which reacts with alkali to form zirconium hydroxide. The

reaction of zirconium oxychloride with alkali also passes three stages: first ZrO(OH)Cl forms, then 7 $ZrO(OH)_2 \cdot ZrOCl_2$, which reacts with NaOH to form zirconium hydroxide. (R.V.J.)

13737

PHASE DIAGRAM OF LiOH–LiCl AND LiOH–NaOH. N. A. Reshetnikov and G. M. Unzhakov. Zhur. Neorg. Khim. 3, 1433-8(1958) June. (In Russian)

Thermographic and visual polythermal methods were used in studies of LiOH–LiCl and LiOH–NaOH systems. Binary compounds form in both systems. (R.V.J.)

Aerosols

13738 CML-M-124-4

Chicago. Univ. Chicago Midway Labs.

HIGH-ALTITUDE SAMPLING TECHNIQUES. Progress Report [for] June 1958. Michael F. Malis. 13p. Contract AT(11-1)-508. (CML-SR-M-124-4). $3.30(ph OTS); $2.40(mf OTS).

The development of the high-altitude air sampler continued with laboratory work on environmental tests, Styrofoam shock absorber tests, revision of the unit, and the first operational flight. (See also CML-M-124-3.) (T.R.H.)

Analytical Procedures

13739 AECU-3795

Knolls Atomic Power Lab., Schenectady, N. Y.

THE DETERMINATION OF DISSOLVED ARGON IN WATER. E. L. Shirley, C. F. Pachucki, and L. K. Lolos. [Oct. 7, 1957]. 16p. Contract W-31-109-Eng-52. (M-6443). $3.30(ph OTS); $2.40(mf OTS).

Dissolved argon in the primary coolant water of a nuclear reactor presents a problem of accessibility to the reactor at shut down. Due to the production of radioactive Ar^{41} from the naturally occurring argon, it is desirable to limit the concentration of argon in the make-up water by some means of deaeration. Two methods for the analysis of dissolved argon at low concentrations are described. Both methods depend upon a mechanical separation of the dissolved gas from the water and an analysis of the separated gas by a mass spectrometer. Data are shown for recoveries from standard samples which demonstrate a standard deviation of ± 0.02 ppm. (auth)

13740 AERE-HP/R-2381

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

MEASUREMENTS ON THE NEAR-GROUND RADON CONCENTRATION ON THE A.E.R.E. AIRFIELD. H. J. Gale and L. H. J. Peaple. Apr. 1958. 18p.

Continuous measurements have been made of the near-ground radon concentration on the A.E.R.E. airfield during the period October 1950 to October 1951, by drawing air through a moving filter strip and measuring the beta disintegration rate of the radon decay products thus collected. A marked diurnal variation was observed, closely following a similar variation in the potential temperature gradient between 32 and 108 feet. On the average the concentration varied during the day by a factor of 2.5. The average concentration over a year was 64 $\mu\mu c/m^3$ and the maximum recorded 386 $\mu\mu c/m^3$. (auth)

13741 HW-54032

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE INFLUENCE OF THE MATRIX ON THE CARRIER DISTILLATION OF METALLIC IMPURITIES FROM PuO_2 AND U_3O_8. R. J. Kofoed, Jr. Apr. 10, 1958. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Of the metallic impurities studied, chromium, copper, nickel, and magnesium (to a limited extent) as determined in a PuO_2 matrix show higher recoveries when read against plutonium standards than when read against U_3O_8 standards. The background on the plutonium standard films was more uniform than the background on uranium films, and there was very little evidence of plutonium having been distilled off with the metallic impurities. Some elements showed an increase in sensitivity in the PuO_2 standards and several lost sensitivity. It was also found that PuO_2 samples diluted with U_3O_8 for analytical purposes should be compared to PuO_2 standards, not U_3O_8 standards. (auth)

13742 IDO-14437

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

EXTRACTION, SPECTROPHOTOMETRIC METHOD SPECIFIC FOR MICROGRAM AMOUNTS OF URANIUM. Glenn L. Booman, William J. Maeck, Maxine C. Elliott, and James E. Rein. July 25, 1958. 15p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

An extraction, spectrophotometric method has been developed specific for the determination of microgram quantities of uranium in the presence of large concentrations of diverse ions. Tetrapropylammonium uranyl trinitrate is extracted into methylisobutyl ketone from an acid deficient aluminum nitrate salting solution, followed by a single citric, tartaric, ethylenediaminetetraacetic acid scrub. Color development is made in situ by the addition of dibenzoylmethane in an ethanol-pyridine mixture. The molar absorptivity at 415 mμ is 16,500. The coefficient of variation is 0.71% at the 25-μg level. The lower limit of detection is 0.5 μg. (auth)

13743 IDO-14438

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

EXTRACTION, DIRECT SPECTROPHOTOMETRIC METHOD SPECIFIC FOR LARGE AMOUNTS OF URANIUM. William J. Maeck, Glenn L. Booman, Maxine C. Elliott, and James E. Rein. July 28, 1958. 14p. Contract AT(10-1)-205. $3.30(ph OTS); $2.40(mf OTS).

An extraction, spectrophotometric procedure was developed specific for the determination of large quantities of uranium in the presence of molar concentrations of diverse ions. The method is based on the quantitative extraction of tetrapropylammonium uranyl trinitrate with methyl isobutyl ketone from an acid deficient aluminum nitrate salting solution, followed by a direct absorbance reading of the organic phase at 452 mμ. The molar absorptivity at this wave length is 31.4. The coefficient of variation is 0.71% at the 10-mg level. The method is simple and rapid. The uniqueness of the spectrum is useful as a qualitative indication of uranium and as a means for readily observing interferences. (auth)

13744 WAPD-81(Rev.)

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

THE ISOTOPIC ANALYSIS OF URANIUM BY RADIOACTIVITY AND SPECTROGRAPHIC MEASUREMENTS. N. E. Gordon, Jr., R. A. Brightsen, H. D. Cook, and C. R. Wilson. June 1, 1952. Decl. Mar. 20, 1957. 38p. $6.30(ph OTS); $3.00(mf OTS).

An accountability procedure for U of high enrichment

is outlined as a substitute for high resolution mass spectrographic determinations. U^{234} is determined by alpha counting, U^{238} by emission spectrography, impurities by grating spectrograph, and U^{235} content is calculated by difference. (J.E.D.)

13745 WAPD-CTA(GLA)-431

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

THE DETERMINATION OF URANIUM AS AN IMPURITY IN ZIRCONIUM AND ZIRCALOY. D. L. Smith, H. R. Wilson, and G. W. Goward. Sept. 11, 1957. $1.80(ph OTS); $1.80(mf OTS).

The determination of uranium in zirconium and Zircaloy in the range 0.25 to 20 ppm on a one gram sample basis. These limits can be varied by changing the size aliquot used for the final uranium determination. Samples are dissolved in hydrofluoric acid and water. Sulfuric acid is added, and the solutions are taken to dryness. The sulfates are dissolved in hot water and the solutions made 2.3 M in nitric acid and saturated in aluminum nitrate. Uranium is then extracted with diethyl ether. After removing the ether, an aliquot is fused with a button of sodium fluoride. The fluorescence produced by the uranium is measured with a photoelectric fluorometer. (auth)

13746 WAPD-CTA(GLA)-620

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

THE DETERMINATION OF MOLYBDENUM AND TUNGSTEN AS IMPURITIES IN NIOBIUM. D. V. Reed, H. R. Wilson, and G. W. Goward. July 15, 1958. 7p. $1.80(ph OTS); $1.80(mf OTS).

A method is presented for the determination of Mo in the range 50 to 1000 ppm and W in the range 25 to 550 ppm in Nb, on the basis of an aliquant representing 0.2 g of Nb sample. Toluene-3,4-dithiol forms colored complexes in acid solution with Mo and W which are extracted with isoamyl acetate. (J.R.D.)

13747 AERE-Lib/Trans-788

USE OF RADIOACTIVE ISOTOPES IN ANALYTICAL CHEMISTRY. I. P. Alimarin and N. A. Rudnev. Translated by S. Botcharsky (U.K.A.E.A., Atomic Energy Research Establishment) from Z. Anal. Khim. 12, 587-92(1957). 9p.

Methods of using radioisotopes in analytical chemistry are briefly reviewed. Problems of the theory of analytical chemistry, separation of the elements, and quantitative determination of the elements are noted. (J.E.D.)

13748

NEW RAPID ELECTROGRAVIMETRIC METHODS. II. DETERMINATION OF BISMUTH IN NITRIC ACID MEDIUM. Gh. Facsko and I. Radoi. Acad. rep. populare Romine Baza cercetari stiint. Timisoara Studii cercetari stiint. Ser. stiint. chim. 4, No. 3-4, 107-13(1957). (In Roumanian)

In a previous paper (Acad. rep. Populare Romine Baza cercetari stiint. Timisoara Studii cercetari stiint. Ser. I 2, No. 1-4, 143(1955)) a new electrogravimetric method was presented in which the principle was the vibration of the electrode with a convenient frequency and amplitude. The advantage of the vibrating electrode was that without loss of the solution by splashing, the method assured a strong agitation of the diffusion layer and reduced the polarization of the solution. This method is applied to the determination of bismuth in a nitric acid medium. It is found that the vibration not only shortens the deposition time but it also has a favorable effect on the structure of the deposit. The conditions are given for the determination of bismuth in 15 minutes with a relative error of 0.2%. (tr-auth)

13749

NEW RAPID METHOD FOR THE SEMI-MICROCHEMICAL DETERMINATION OF CADMIUM AND COPPER BY A GRAVIMETRIC PROCESS. J. Dick and Fr. Hihai. Acad. rep. populare Romine Baza cercetari stiint. Timisoara Studii cercetari stiint. Ser. stiint. chim. 4, No. 3-4, 91-5(1957). (In Roumanian)

Two rapid gravimetric methods for the semi-microchemical determination of cadmium and copper are described. The methods are based on the formation of the nitromalonylurea of cadmium and copper. The metals are precipitated with 5-nitrobarbituric acid, and Cd and Cu can be determined in milligram quantities. In addition to being relatively specific, the methods are precise and quite rapid. (tr-auth)

13750

NEW METHOD FOR THE SEPARATION OF BISMUTH FROM CADMIUM AND COPPER AND ITS DETERMINATION. Fr. Mihai. Acad. rep. populare Romine Baza cercetari stiint. Timisoara Studii cercetari stiint. Ser. stiint. chim. 4, No. 3-4, 123-8(1957). (In Roumanian)

A rapid method for the separation of bismuth from cadmium and copper and their determination is given. The separation and determination of bismuth is made on the bismuth gallate and the determination of cadmium and copper is made on the dilliturate. The bismuth is weighed directly as the gallate, and the determination takes from 15 to 20 minutes. As the copper and cadmium do not precipitate with the gallic acid, one can determine them in the filtrate by precipitation with dilituric acid. They are weighed as the dilliturates. The reduction of the volume takes approximately 30 min, and the determination of the elements in the mixture can be made in one hour. (tr-auth)

13751

GRAVIMETRIC DETERMINATION OF BISMUTH USING HYPOPHOSPHOROUS ACID. Donald R. Bomberger (Univ. of California, Livermore). Anal. Chem. 30, 1321-2(1958) Aug.

A simple method is provided for gravimetric determination of bismuth in the presence of a number of metallic elements. Bismuth is reduced to the metal by hypophosphorous acid from a perchloric acid solution, dried, and weighed. (auth)

13752

POTENTIOMETRIC TITRATIONS WITH (ETHYLENEDINITRILO)TETRAACETATE. USE OF MASKING AGENTS TO IMPROVE SELECTIVITY. James S. Fritz, Marlene J. Richard, and Shirley K. Karraker (Iowa State Coll., Ames). Anal. Chem. 30, 1347-50(1958) Aug.

Potentiometric titration of metal ions with EDTA using a mercury metal indicator electrode is a useful but rather nonselective method. Complexing agents mask certain interfering metal ions to allow interesting and selective analytical determinations. With citrate as a masking agent, cadmium(II), copper(II), mercury(II), or zinc(II) can be titrated in the presence of beryllium(II), chromium(III), iron(III), molybdenum(VI), niobium(V), antimony(III), tin(IV), tantalum(V), thorium(IV), titanium(IV), uranyl(II), tungsten(VI), and zirconium(IV). In some cases tartrate can be substituted successfully for citrate. Rare earths and some bivalent metal ions can be titrated in the presence of aluminum or uranium, using 2,4-pentanedione or sulfosalicylate as a masking agent. (auth)

13753

DETERMINATION OF TRACES OF BORON IN NICKEL. C. L. Luke (Bell Telephone Labs., Inc., Murray Hill, N. J.). Anal. Chem. 30, 1405-6(1958) Aug.

Traces of boron in nickel are determined by dissolving the sample in a small amount of a hydrochloric acid–platinic chloride mixture, isolating the boron by methanol distillation, and determining it by the photometric curcumin method. (auth)

13754

PHOTOMETRIC DETERMINATION OF TRACES OF BORON IN SILICON AFTER SEPARATION BY A HYDROTHERMAL REFINING TECHNIQUE. C. L. Luke and S. S. Flaschen (Bell Telephone Labs., Inc., Murray Hill, N. J.). Anal. Chem. 30, 1406-9(1958) Aug.

The sensitivity of the photometric curcumin method for the determination of boron in silicon has been increased by using a hydrothermal refining technique for the separation of the boron from the silicon. It is now possible to increase the sample size tenfold and to determine as little as 0.02 ppm of boron. Because variables are controlled more closely during color development, the accuracy of the photometric determination itself is improved. The hydrothermal refining process appears to be a powerful new analytical tool that should prove useful in other analyses. (auth)

13755

DETERMINATION OF VANADIUM IN METALS (FERROVANADIUM–VANADIUM ALLOYS) AND THE VANADIC ACIDS. Francis Nouyrigat (Laboratoire Central de Recherches des Établissements Kuhlmann, Levallois-Perret). Bull. soc. chim. France No. 6, 781-5(1958) June. (In French)

A precise study of different volumetric analyses of vanadium published up to the present has shown that none of the analyses are rigorous and that some lead to good results only because of a compensation between systematic errors. It is possible to obtain the determination exact to 0.1% by making the analysis under the control of a potentiometer and modifying the potential appearing in the $Fe^{2+} \rightleftharpoons Fe^{3+}$ system by the use of a complexing agent (H_3PO_4 for example). (tr-auth)

13756

NEUTRON ACTIVATION ANALYSIS IN THE DETERMINATION OF BONE SODIUM. Robert Druyan, Thomas G. Mitchell, and E. Richard King (U. S. Naval Hospital, Bethesda, Md.). J. Lab. Clin. Med. 52, 304-8 (1958) Aug.

Neutron activation analysis techniques have been applied to the determination of bone sodium. Because of the physical characteristics of sodium, it may be easily determined, even in the presence of an abundance of calcium. The technique and results are described, as performed on freeze-dry human cortical bone specimens. (auth)

13757

RAPID PHOTOMETRIC DETERMINATION OF CHROMIUM IN COPPER–CHROMIUM ALLOYS. Hugo Wiedmann. Z. Metallk. 49, 248-9(1958) May. (In German)

A photometric method is described, which because of its quickness of operation may well be used to control melting practice in the production of copper-chromium alloys. One analysis requires 10 to 15 minutes only. The accuracy is ±0.02%. The method may also be applied to other alloys. (auth)

13758

PHOTOMETRIC DETERMINATION OF THORIUM WITH ARSENAZO IN THE PRESENCE OF ZIRCONIUM, TITANIUM AND RARE EARTHS. F. V. Zaikovskii and L. I. Gerkhardt (All-Union Inst. of Mineral Raw Materials, Moscow). Zhur. Anal. Khim. 13, 274-9(1958) May. (In Russian)

It has been established that the interference of zirconium, titanium, and rare earths, during the photometric determination of thorium with arsenazo (uranon, benzol-2-arsonium acid-<1-azo-7>-dioxynaphthalene-3.6-disulfonic acid), can be eliminated by means of tartaric acid. A method was developed for determining thorium with arsenazo in the presence of the above mentioned elements. (tr-auth)

13759

SPECTROGRAPHIC DETERMINATION OF CALCIUM, MAGNESIUM, ALUMINIUM, SILICON AND TIN IN AFFINED RHODIUM AND IRIDIUM. A. V. Babaeva and O. N. Evstafyeva (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Zhur. Anal. Khim. 13, 304-7(1958) May. (In Russian)

A method was developed for the spectrographic analysis of affined rhodium and iridium for calcium, magnesium, aluminum, silicon, and tin. A method is suggested for preparing reference rhodium and iridium solutions containing small amounts of calcium, magnesium, aluminum, silicon and tin. (tr-auth)

13760

DIALKYL- AND DIARYLDITHIOPHOSPHORIC ACIDS AS ANALYTICAL REAGENTS. COMMUNICATION 4. SEPARATION OF CADMIUM FROM ZINC AND OTHER ELEMENTS GRAVIMETRIC AND TITRIMETRIC DETERMINATION OF CADMIUM. O. I. Busev and M. I. Ivanyutin (Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 13, 312-18(1958) May. (In Russian)

A fairly rapid gravimetric method for determining cadmium in the presence of zinc as well as nickel, cobalt, manganese, aluminum, iron, chromium, magnesium, alkali-earth, and alkali metals was developed; it is based on the formation of cadmium diethyldithiophosphate $[(C_2H_5O_2)PSS]_2Cd$ which is suitable for separating and weighing. The method can be used for the analysis of natural and industrial materials. (tr-auth)

13761

THE USE OF SODIUM-2-AMINOBENZOATE FOR THE TITRIMETRIC DETERMINATION OF CADMIUM. A. I. Portnov and A. I. Vasyutinskii (Pharmaceutical Inst., Odessa). Zhur. Anal. Chem. 13, 319-23(1958) May. (In Russian)

A new titrimetric method was developed for determining cadmium in the presence of zinc. (tr-auth)

13762

NEW FLUORIMETRIC METHOD FOR THE DETERMINATION OF GALLIUM. V. A. Nazarenko and S. Ya. Vinkovetskaya (Inst. of General and Inorganic Chemistry, Academy of Sciences, Ukrainian SSR). Zhur. Anal. Khim. 13, 327-31(1958) May. (In Russian)

The use of the reaction with 1.3–dihydroxy benzene-<4-azo-1>-2-naphthol-4-sulfonic acid for the quantitative fluorimetric determination of gallium is described. A method was developed for the determination of gallium in ores, coals, metals, and non-ferrous metal industry waste materials. The sensitivity of the method is up to 10^{-5} %. (tr-auth)

13763

AMPEROMETRIC TITRATION OF TETRAVALENT URANIUM WITH AMMONIUM VANADATE. Yu. V. Morachevskii and I. A. Tserkovnitskaya (Zhdanov Leningrad State Univ.). Zhur. Anal. Khim. 13, 337-9 (1958) May. (In Russian)

The amperometric titration determination of U^{4+} (up to 2.5 μg/ml) with an ammonium vanadate solution is accurate to 1 to 3%. The influence of a number of interfering ions can be eliminated by introducing o-phenanthroline when iron is determined, and complexone III at the determination of chromium, nickel, lead, and bismuth. The mean error of the determination of uranium is 3 to 4%. (tr-auth)

13764

SPECTRAL ANALYSIS BY MEANS OF EVAPORATION. COMMUNICATION 6. THE DETERMINATION OF CADMIUM, GERMANIUM, INDIUM, GALLIUM, GOLD, STIBIUM AND LEAD IN URANOUS-URANIC OXIDE. N. I. Kaliteevskii, A. A. Lipovskii, A. N. Razumovskii, and P. P. Yakimova (Zhdanov Leningrad State Univ.). Zhur. Anal. Khim. 13, 372-3(1958) May. (In Russian)

Cadmium and indium do not volatilize completely when admixtures are evaporated from U_3O_8 at 1600 to 1700°. In order to avoid a systematic error in the spectral determination, it is necessary to carry out the sublimation of cadmium and indium admixtures at 2000°. (tr-auth)

Crystallography and Crystal Structure

13765

ELECTRON DIFFRACTION PATTERN STUDY OF ZIRCONIUM DIOXIDE POLYMORPHISM IN THIN FILMS. I. I. Korobkov and D. V. Ignatov. Doklady Akad. Nauk S.S.S.R. 120, 527-30(1958) May 21. (In Russian)

Zirconium dioxide polymorphism was studied by heating thin films of cubic ZrO_2 in vacuum, oxygen, and air. Identical regular transformations of cubic phase into tetragonal and finally into monoclinic phase at identical temperatures were observed in all cases. The results showed that the polymorphous transformations are inherent to ZrO_2 and are not influenced by oxygen solubility in ZrO_2 or by the ZrO_2 reaching the exact stoichiometric composition; neither were they influenced by the nitrogen in the air. The data indicate that the monocline ZrO_2 is a stable form and is the final product of ZrO_2 transformations at 300 to 1300°C. (R.V.J.)

13766

ON THE ELECTRICAL PROPERTIES OF POLYCRYSTALLINE BORON. Ryosei Uno (Scientific Research Inst., Tokyo). J. Phys. Soc. Japan 13, 667-75(1958) July.

Several specimens of polycrystalline boron, which have various electrical conductivities at room temperature, ranging from 8(ohm cm)$^{-1}$ to 5×10^{-3} or less, were obtained by reduction of distilled boron tribromide. The spectroscopic analysis and the observation by the Debye-Scherrer x-ray pattern were carried out. Some evidence was obtained showing that the conductivity at room temperature may not increase with the amount of impurities but it depends rather on the difference in the crystal structure. Assuming a simple model, carrier concentration and mobility were estimated from the data on conductivity and thermoelectric power. The result was that the carrier concentration may be nearly constant over the range from 100 to 1000°K and that the mobility may vary exponentially with the reciprocal of absolute temperature. (auth)

13767

ETCHING OF RADIATION DAMAGE IN LITHIUM FLUORIDE. D. A. Young (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nature 182, 375-7(1958) Aug. 9.

Single crystals of lithium fluoride were cleaved along the plane, and fission fragments from a U_3O_8 film 1 mm distant were allowed to enter a portion of the crystal surface at room temperature. The crystals were then etched in an acid bath and photographed in a projection microscope. The damage produced in the crystals by recoiling fission fragments is demonstrated. (C.H.)

13768

CRACK FORMATION IN MAGNESIUM OXIDE SINGLE CRYSTALS. R. J. Stokes, T. L. Johnston, and C. H. Li (Minneapolis-Honeywell Research Center, Hopkins, Minn.). Phil. Mag. (8) 3, 718-25(1958) July.

Experimental evidence is presented which lends direct support to the Stroh mechanism for crack formation. After a magnesium oxide crystal was compressed about 3%, it was observed that minute cracks had been formed in the region of a kink band generated by nonhomogeneous plastic strain. These cracks lay on conjugate {110} slip planes and not on the usual {100} cleavage planes. They extended in the form of [001] direction slits running right through the crystal. (auth)

13769

DISTRIBUTION OF THE MICRO-COMPONENT BETWEEN THE MELT AND THE CRYSTALLINE PHASE. V. R. Klokman. Zhur. Neorg. Khim. 3, 33-5(1958). (In Russian)

An investigation of the distribution of the microcomponent between the melt and the crystalline phase shows that the behavior of the microcomponent in the melt is, in some respects, analogous to that in the solution. In the melt, however, the solid phase does not separate according to the logarithmic law. Further, no coprecipitation of lead with the halides of the alkali metals was observed. The distribution of Ra in binary systems of alkali metal halides and binary metal ion halides and in systems in which the alkali metal halide was replaced by the chlorides of lead and zinc was studied, and the crystallization coefficient of Ra was determined. The use of $CdCl_2$ and $ZnCl_2$ reduced the value of the crystallization coefficient. No co-crystallization of Ra and Pb occurred below 410°C. The reduction in the crystallization coefficient is discussed and a possible reason is given. (J.S.R.)

Deuterium and Deuterium Compounds

13770 AEC-tr-3329

PARAMAGNETIC RESONANCE OF PRODUCTS FORMED AT LOW TEMPERATURES BY THE DISSOCIATION IN THE GLOW DISCHARGE OF H_2O, H_2O_2 AND D_2O VAPORS. A. I. Gorbanev, S. D. Kaitmazov, A. M. Prokhorov, and A. B. Tsentsiper. Translated by the Oak Ridge National Lab., Library Staff from Zhur. Fiz. Khim. 31, 515(1957). 3p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 9239.

13771

VALENCE VIBRATION OF THE MOLECULES H_2O, D_2O, AND HDO IN ORGANIC SOLVENTS. Pierre Saumagne and Marie-Louise Josien (Centre de Physico-Chimie Structurale, Bordeaux). Bull. soc. chim. France No. 6, 813-20(1958) June. (In French)

The valence vibrations were studied by infrared spectroscopy of the molecules H_2O, D_2O, and HDO in a series of organic solvents. The relative lowering of the frequency is discussed as a function of the Kirkwood-Bauer-Magat theory. The structure of the complexes formed with certain solvents was analyzed. (tr-auth)

13772

PREPARATION OF ETHANOL (D_3)-2. M. Corval (Laboratoire de Chimie Physique, Paris). Bull. soc. chim. France No. 7, 969-70(1958) July. (In French)

Methods of preparing deuterated ethanol CD_3CH_2OH from deuterated acetic acid (D_4) and from deuterated methyl alcohol (D_4) were investigated. The method utilized was the classic method of preparation of primary alcohols: condensation of CD_3MgBr with formaldehyde, and then hydrolysis. The ethanol prepared in this manner is high purity, higher than 99%. (J.S.R.)

13773

ISOTOPIC EFFECT IN THE CRITICAL TEMPERATURE. I. B. Rabinovich and V. A. Gorbushenkov (Lobachevskii Gor'kii State Univ.). Doklady Akad. Nauk S.S.S.R. 120, 566-9(1958) May 21. (In Russian)

Comparisons of the critical temperatures for deuterium complexes C_6H_6, C_6D_6, $C_6H_5CH_3$, $C_6D_5CH_3$, CH_3NO_2, CD_3NO_2, $CHCl_3$, $CDCl_3$, CH_3COOH, and CH_3COOD and their aqueous analogs C_2H_5OH, C_2H_5OD, $CH_3(CH)_2OH$, $CH_3(CH_2)_2OD$, $(CH_3)_2CHOH$, $(CH_3)_2CHOD$, $CH_3(CH_2)_3OH$, $CH_3(CH_2)_3OD$, $(CH_3)_2CHCH_2OH$, $(CH_3)_2CHCH_2OD$, $CH_3CH_2CHOHCH_3$, and $CH_3CH_2CHODCH_3$ showed that in all cases the replacement of H by D reduces the critical temperature. In the temperature range of liquid helium and hydrogen the replacement of H by D increases the Van der Waal interactions, i.e., it results in a reverse effect, opposite to the effect at mean temperatures. (R.V.J.)

Fluorine and Fluorine Compounds

13774 NACA-RM-E58D11

Lewis Flight Propulsion Lab., Cleveland.

COMPATIBILITY OF METALS WITH LIQUID FLUORINE AT HIGH PRESSURES AND FLOW VELOCITIES. Harold W. Schmidt. July 15, 1958. 16p.

Nickel, stainless steel, brass, and aluminum were evaluated for compatibility with liquid fluorine at flow velocities up to approximately 400 ft/sec and pressures up to 1500 lb/sq in. gage. Configurations were varied to produce severe turbulence and impact effects. Two rotating-vane flowmeters were also tested. None of the metals exhibited any measurable physical or chemical changes. In a run made with Teflon, fluorine reacted violently. (auth)

13775

THE NUCLEAR MAGNETIC RESONANCE OF FLUORINE IN FLUOROSILANES. Erhard Schnell and Eugene G. Rochow (Mallinckrodt Lab. of Chemistry). J. Inorg. & Nuclear Chem. 6, 303-7(1958) July.

The F^{19} nuclear magnetic resonance in methyl and ethyl fluorosilanes was measured relative to diethyldifluorosilane, both for the pure substances and for solutions at varying concentration in carbon tetrachloride. The chemical shift of fluorine (especially at infinite dilution in carbon tetrachloride) is considered in relation to the structure of the compounds and the bonding properties of silicon. The H^1 nuclear magnetic resonances of the methyl and ethyl chloro and fluoro silanes (relative to water) also were measured, and no separation of the proton resonance in $-CH_3$ and $-CH_2-$ groups were found. (auth)

13776

THE VAPOR PRESSURE OF NICKEL FLUORIDE. Milton Farber, Richard T. Meyer, and John L. Margrave (California Inst. of Tech., Pasadena and Univ. of Wisconsin, Madison). J. Phys. Chem. 62, 883-4(1958) July.

The vapor pressure of NiF_2 was measured by two different methods to determine if metal fluorides were sufficiently volatile at high temperatures to complicate the interpretation of fluorine dissociation energy data taken from metal systems. The resulting vapor pressure equation is presented. The data indicate a negligible effect on fluorine dissociation measurements. (D.E.B.)

Graphite

Refer also to abstract 14406.

13777

INTERSTITIAL COMPOUNDS OF IRRADIATED GRAPHITE. G. L. Montet (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 4, 112-33(1958) July.

As the result of an attempt to prepare unordered compounds of graphite containing more than 1.5×10^{-3} acceptor per carbon atom by the introduction of both chemical acceptors and radiation damage centers, evidence has been found for mutual destruction of chemical acceptors and damage centers. An analysis of the kinetic behavior of the mutual destruction indicates that the extent of destruction is independent of the order in which the radiation damaging and chemical treatments are carried out. From some auxiliary experiments made necessary by the discovery of the above interaction it is concluded that the graphite bisulfate residue compounds are stable at room temperature, and that the bisulfate ion is not appreciably decomposed by the gamma flux in the reactor during short irradiations. The dependence of some electrical properties of graphite on the concentrations of both chemical acceptors and radiation damage centers has been analyzed on the basis of the two-band theory of a semiconductor above its degeneracy temperature. It is concluded that whereas the Hall effect may be reasonably well understood the behaviors of the electrical resistance and magnetoresistance cannot be understood in terms of this theory, so that the introduction of additional hypotheses appears necessary. (auth)

13778

REACTOR GRAPHITE. Andrzej Grossman. Nukleonika 3, 273-86(1958). (In Polish)

The general significance of graphite in reactor techniques, the basic properties, and production methods employed are described. The Polish work with graphite is outlined. Analysis and selection of pure raw-materials and graphitization are discussed. (tr-auth)

Laboratories and Equipment

Refer also to abstract 14390.

13779 AECU-3793

Michigan. Univ., Ann Arbor.

ALTERNATING CURRENT POLAROGRAPHY: EVALUATION OF THE ACCURACY OF THE DATA AND CALCULATION PROCEDURES. Report No. 36. Henry H. Bauer and Philip J. Elving. July 23, 1958. 36p. Project No. 8. Contract AT(11-1)-70. $6.30(ph OTS); $3.00(mf OTS).

The data obtained by a-c polarography, when used to determine electrode parameters such as heterogeneous rate constant and when used as an analytical tool, are evaluated. Certain aspects of the experimental approach both in measurement and calculation are re-

viewed. The importance and means of correcting for the series resistance of the cell system itself and of using equations which take into account the phase differences between the faradaic and capacitive currents are developed. Other topics reviewed include the nature of the dependence of the peak a-c on depolarizer concentration, effect of adsorption of depolarizer and electrode, and a simplified procedure for quantitative analysis. (auth)

13780 CF-58-7-87
Oak Ridge National Lab., Tenn.
MEASUREMENTS THROUGH A HOT CELL WINDOW USING OPTICAL TOOLING. A. A. Abbatiello. July 18, 1958. 49p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

Optical tooling has been evaluated for the measurement of physical dimensions of radioactive parts through hot cell windows. Instruments were set up outside of a four foot thick lead glass window and by means of a grid plate which had been accurately scribed, a "contour map" or calibration chart of the window variations was recorded. Although the window was not specially selected, the readings were within 1.0% of the true dimension without using correction factors. One of the calibration chart with the window reduced the error to ±0.1%. The method is considered feasible and sufficiently fast for a wide variety of hot cell measurements. A pin point light source is suggested as a simple check for selective assembly of lead glass laminates during manufacture of hot cell windows to provide control of optical properties. (auth)

13781
DESIGN, INSTALLATIONS, AND EQUIPMENT FOR A RADIOISOTOPE LABORATORY. George G. Manov (Atomic Energy Commission, Washington) and Eduardo Schalscha B. (Universidad de Chile, Santiago). Bol. centro Investigaciones Nucleares Universidad Chile 1, 3-20(1957) Nov. (In Spanish)

In the design of a radioisotope laboratory there must be a balance between the work program, number of personnel, necessary equipment, and cost. A review is presented of the equipment and installations necessary for laboratories handling either low- or high-level activities. Approximate cost figures are given. (J.S.R.)

13782
DESIGN AND MANAGEMENT OF A NUCLEAR SCIENCE LABORATORY. A. J. Woodall, C. G. Wilson, A. L. Jones, and D. K. Thomas (Royal Military Coll. of Science, Shrivenham). Nature 182, 367-9(1958) Aug. 9.

A laboratory is described which was specially designed for teaching nuclear physics and chemistry. (C.H.)

13783
A PRACTICAL DEVICE FOR CHROMATOGRAPHIC SEPARATIONS. B. K. Preobrazhenskii. Zhur. Neorg. Khim. 3, 119-20(1958). (In Russian)

A description is given of a practical device for chromatographic separation. It completely prevents formation of bubbles in the columns, and complete reproducibility of results is obtained. The air pressure after preliminary degassification of the solution is maintained by the use of a hollow glass float closely fitting the walls of the tube. (J.S.R.)

Molecular Structure

13784
INVESTIGATION OF HEXAMETHYLENE TETRAMINE BY NEUTRON DIFFRACTION. Arne F. Andresen (Joint Establishment for Nuclear Energy, Kjeller, Norway). Acta Cryst. 10, 107-10(1957).

Hexamethylenetetramine was re-investigated by neutron diffraction in order to determine the exact positions of the hydrogen atoms. The space group is found to be $I\bar{4}3_m$, and the parameters lead to C–H bonds of lengths 1.13 A forming angles of 110° 6′. An anisotropic temperature factor is introduced, based on the assumption of the molecule rotating as a rigid constellation. This leads to a remarkably good agreement between observed and calculated structure factors. (auth)

Radiation Chemistry

Refer also to abstract 13646.

13785 AECU-3786
Wisconsin. Univ., Madison.
TEMPERATURE AND PHASE EFFECTS ON THE PHOTOLYSIS OF ETHYL IODIDE. Ray H. Luebbe, Jr. and John E. Willard. [1958.] 31p. Contract [AT(11-1)-32]. $6.30(ph OTS); $3.00(mf OTS).

The elementary steps in the photolysis of liquid ethyl iodide by light of wavelength 2537 A by determining initial rates of iodine production in the presence of added iodine and hydrogen iodide were analyzed at 25 and –70°C to get information on the activation energies of competing elementary reactions. Investigations were also made of the effects of additives on the photolysis of glassy ethyl iodide at –180°C, and evidence for the formation of trapped radicals during photolysis and radiolysis of the solid was sought by electron paramagnetic resonance measurements. (J.R.D.)

13786
THE RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS OF (^{14}C)BENZOIC AND (^{14}C)SALICYLIC ACIDS. A. M. Downes (Univ. of Melbourne). Australian J. Chem. 2, 154-67(1958) May.

Tracer techniques were used to study the effects of gamma radiation from Co^{60} and 45-kv x rays on C^{14}-labeled benzoic acid and on carboxy-C^{14} labeled salicylic acid in aqueous solutions. The products of these irradiations are described, and the results are compared with other results relating to free-radical reactions. (J.R.D.)

13787
EMANATING POWER OF BARIUM STEARATE FOR 3.9-SECOND ACTION (^{219}Rn). Arthur C. Wahl and William R. Daniels (Washington Univ., St. Louis). J. Inorg. & Nuclear Chem. 6, 278-87(1958) July.

The emanating power of barium stearate powder for actinon is >99% for thin layers in air at atmospheric pressure and for ≈10 mg/cm^2 layers at reduced pressures (≤7.5 mm Hg). The emanating power decreases with increasing pressure and with increasing thickness at atmospheric pressure. The method of preparation of the highly emanating barium stearate and two methods of measurement of the emanating power are described. Some preliminary results on gas sweeping of actinon and thoron from aqueous solution are also given. (auth)

13788
GEL FORMATION OF AQUEOUS SOLUTION OF POLYVINYL ALCOHOL IRRADIATED BY GAMMA RAYS FROM COBALT-60. Akibumi Danno (Univ. of Tokyo). J. Phys. Soc. Japan 13, 722-7(1958) July.

Experiments were carried out on the irradiation of aqueous solution of polyvinyl alcohol by gamma rays. For sufficient dose of radiation, the polymer molecules in the solution interlinked with each other and formed

an insoluble gel. The change in degree of polymerization of the polymer with the absorbed dose, and the minimum dose R_g, required to produce a gel, were measured as a function of concentration of polyvinyl alcohol. In dilute solutions below the critical concentration, gel formation did not occur even for prolonged irradiation. Some considerations are given on the phenomena. (auth)

Radiation Effects

Refer also to abstract 13777.

13789 NP-6837

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

MONTHLY ACCESSION LIST NO. 13 [ON RADIATION EFFECTS DATA]. July 15, 1958. 20p. Project No. 2133. Contract AF33(616)-5171.

The accession list includes the following categories: general background; electrical and electronic systems; polymeric materials; fuels, lubricants, and hydraulic fluids; ceramic materials; metals and alloys; organic chemicals; facilities; dosimetry; and a miscellaneous section. (J.R.D.)

13790

NEUTRON IRRADIATION EFFECTS IN BOROSILICATE GLASS AND THEIR DETECTION BY ULTRASONIC ATTENUATION AND VELOCITY MEASUREMENTS. Rohn Truell and John deKlerk (Brown Univ., Providence, R. I.) and Paul W. Levy (Brookhaven National Lab., Upton, N. Y.). J. Appl. Phys. 29, 225-6(1958) Feb.

The damage or irradiation effects arising from the reaction of slow neutrons with B^{10} were detected and observed in a boron glass by means of high-frequency ultrasonic attenuation. The glass used (Corning 7070) contained 28% by weight of B_2O_3, or approximately 8% B. Irradiation for more than an hour in the Brookhaven Reactor caused the glass samples to crack. Reactor irradiation of 15, 30, 45, and 60 minutes produced both attenuation and velocity changes that could be measured in the frequency range from 10 to 50 Mc/sec. The results show an attenuation increase of approximately 50% at a frequency of 50 Mc/sec in a sample irradiated for 30 min and somewhat less for an irradiation of 60 min. The ultrasonic velocity for transverse waves at 10 Mc/sec decreases as a function of increasing irradiation, while at 50 Mc/sec the velocity increases as a function of increasing irradiation. (J.S.R.)

13791

CHEMICAL EFFECTS IN FISSION PRODUCT RECOIL. III. THE DECOMPOSITION OF POTASSIUM NITRATE. D. Hall and G. N. Walton (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 6, 288-94(1958) July.

The effect of the recoil of fission products from uranium foils into an adjacent layer of potassium nitrate was investigated. Under these conditions about 10.5 nitrite ions are formed per 100 ev of recoil energy absorbed. This is considerably greater than the values observed for other forms of radiation and the reasons for this are discussed. (auth)

13792

ELECTRON SPIN RESONANCE STUDIES OF RADIATION DAMAGE TO PEPTIDES. Gene McCormick and Walter Gordy (Duke Univ., Durham, N. C.). J. Phys. Chem. 62, 783-9(1958) July.

Effects of x-irradiation on numerous dipeptides and tripeptides were investigated through observation of the electron spin resonance patterns of the free radicals produced by the irradiation. Most of the resonances have hyperfine structure arising from interaction of the free electron spin with the spins of hydrogen nuclei. The patterns were generally found to be different for different peptides and also different in most instances from those obtained by x-irradiation of their constituent amino acids. With few exceptions the patterns are also different from those obtained from x-irradiation of proteins. Tentative identifications of some of the free radicals produced are made from their proton hyperfine structure. For some of the peptides oxygen was found to kill the resonance and for others to alter its structure. The results indicate that certain groups containing sulfur or the tyrosine ring, when a constituent of a polypeptide or protein, can act as protective agents to prevent radiation damage to other parts of the protein or polypeptide. (auth)

13793

ELECTRON SPIN RESONANCE STUDIES OF RADIATION DAMAGE TO AMINO ACIDS. Howard Shields and Walter Gordy (Duke Univ., Durham, N. C.). J. Phys. Chem. 62, 789-98(1958) July.

The earlier investigation of radiation damage to certain amino acids with the method of electron spin resonance was extended to all the basic amino acids. Most amino acids when x-irradiated were found to have characteristic resonance patterns, each different from those found for the other amino acids. For most of them the characteristic pattern arises from hydrogen nuclear coupling with the electron spin. However, cysteine, cystine, and glutathione gave very similar resonance patterns. For these compounds the structure of the resonance appears to arise mainly from an anisotropy in the g-factor rather than from nuclear interactions. The common pattern of these sulfur-containing amino acids suggests that the odd electron is mainly localized on the sulfur. The absence of resolvable structure for the resonances of x-irradiated tyrosine and tryptophan suggests that the odd electron giving the resonance may be migrating within the unsaturated rings of these substances. The evidence indicates that the tyrosine and tryptophan rings, in addition to sulfur groups, may in certain combinations act as protective agents to prevent radiation damage to other parts of the molecule. Tentative identifications of the free radicals produced by irradiation of a few of the acids are made from the structure of the resonances. (auth)

13794

CHEMICAL EFFECTS IN THE IRRADIATION OF POLYMERS IN THE SOLID STATE. J. Weiss (Univ. of Durham, Eng.). J. Polymer Sci. 29, 425-32(1958) June.

The action of ionizing radiations on polymers leads, in general, to degradation and, in certain cases, to some further polymerization (crosslinking). It is known, on general physical grounds, that the energy of the radiation is converted into ionization and excitation of the molecules present in the system. The question arises as to how the radiation-produced primary species enter into the mechanism of the subsequent chemical processes. It is suggested that electronic processes are of considerable importance in the radiation-induced reactions of solid polymers; this is discussed with reference to various physical and chemical data on irradiated polymers (radiation-induced electrical conductivity, paramagnetic resonance, etc.). A unified picture for the

mechanism of the action of ionizing radiations is proposed, based on the zone theory of solids. (auth)

13795

THE RELATIVE EFFECTS OF DIRECT AND INDIRECT ACTIONS OF IONIZING RADIATIONS ON DEOXYRIBONUCLEIC ACID. J. A. V. Butler, R. H. Pain, and A. B. Robins (Chester Beatty Research Inst., London); and J. Rotblat (St. Bartholomew's Hospital Medical Coll., London) Proc. Roy Soc. (London) B149, 12-20(1958) July.

The effectiveness of ionizing radiations in damaging the DNA particle, as determined by the number of primary ionizations in the volume occupied by each particle, which is required to reduce the intrinsic viscosity to half its original value has been determined over a range of concentrations from 0.01 to 100%. The different specimens of DNA employed differ considerably in sensitivity, but with each specimen the number of ionizations required is approximately constant from 1 to 100%. This means that over this range of concentration an ionization occurring in the water has the same effect as one within the DNA particle. The differences of sensitivity of the different samples are probably due to traces of protein contamination and disappear at the greater dilutions. The effects were independent of the dose rate and of the hardness of the radiations within the ranges used and identical effects were obtained with electrons and x rays. (auth)

13796

THE EFFECTS OF IONIZING RADIATION ON NATURAL AND SYNTHETIC HIGH POLYMERS. Frank A. Bovey. New York, Interscience Publishers, Inc., 1958. 297p.

A critical review is presented treating significant basic research in the field of radiation effects on polymers. The material is divided into chapters on: properties of ionizing radiations, chemical effects of ionizing radiation, general radiation chemistry of polymers, statistical treatment of radiation-induced crosslinking and scission, hydrocarbon polymers, acrylate and methacrylate polymers and miscellaneous oxygen-containing addition polymers, chloro- and fluoropolymers, diolefin polymers, condensation polymers, and natural polymers and derivatives. (T.R.H.)

Rare Earths and Rare-earth Compounds

13797 AECU-3800

Crane Co., Chicago.

PILOT SCALE CONVERSION OF YTTRIUM TRIFLUORIDE TO YTTRIUM METALLIC SPONGE AT CRANE CO. I. J. Dzikowski, J. F. Lenc, and R. G. Mathias. May 16, 1958. 44p. Contract AT(11-1)-502. $7.80 (ph OTS); $3.30(mf OTS).

Yttrium trifluoride was reduced by calcium in the presence of magnesium to form a magnesium–yttrium alloy. This alloy was vacuum distilled to remove the magnesium and other residuals. The yttrium was recovered as a high-purity metallic sponge. A description of the process, equipment, and analytical results, with suitable photographs, sketches, and data, is given. (auth)

13798

THE OXYSULFIDES Me_2O_2S OF THE ELEMENTS OF THE RARE EARTH GROUP. Jean Flahaut, Micheline Guittard, and Madeleine Patrie (Laboratoire de Chimie Minerale, Paris). Bull. soc. chim. France No. 7, 990-4(1958) July. (In French)

The oxysulfides of the general formula Me_2O_2S were prepared with ten elements of the rare earths, Ce, La, Pr, Nd, Sm, Gd, Dy, Er, Yb, and Y. They all have the same crystal structure, the Ce_2O_2S type. They posses particularly high melting points, above 2000°. Differences were observed in their chemical properties which develop progressively from the beginning to the end of the series. In particular, the cerium oxysulfides are easily attacked by acids, the yttrium derivatives less, and the ytterbium oxysulfide is only decomposed by aqua regia. Oxidation in air is not observed below 600° except for cerium oxysulfide which can not be kept in air. Aluminum affects them at high temperatures by selective fixation of oxygen and by leaving a residue of subsulfide MeS. (tr-auth)

13799

DOUBLE CHLORIDES OF CERIUM GROUP ELEMENTS WITH TRIMETHYLAMINE CHLORIDE. N. N. Sakharova and S. V. Zemskov (Chernyshevskii Saratov State Univ.). Doklady Akad. Nauk S.S.S.R. 120, 539-40(1958) May 21. (In Russian)

Binary chlorides of rare elements with trimethylamine in the presence of 96% ethyl alcohol. expressed by the general formula $MeCl_3 \cdot 4(CH_3)_3N \cdot HCl$, where Me is La, Ce, Pr, and Nd, were obtained. Properties of these compounds were studied, and their solubility in water and organic solvents was determined. (R.V.J.)

13800

PHOSPHATES AND POLYPHOSPHATES OF THE RARE EARTH ELEMENTS. II. PYROPHOSPHATO AND TRIPHOSPHATO COMPLEXES OF NEODYMIUM AND YTTRIUM. Ernesto Giesbrecht and L. F. Audrieth (Univ. of Illinois, Urbana). J. Inorg. & Nuclear Chem. 6, 308-13(1958) July.

The hydrogen ion displacement method was employed to verify formation of the normal phosphate, pyrophosphate, and triphosphate of yttrium when precipitation of these substances is effected by reaction of aqueous solutions adjusted to pH of 4.5. Titration of yttrium and neodymium salts with standard solutions of pyro- and triphosphates indicates formation of the normal pyro- and triphosphates in the more acid solutions, and in the case of triphosphate, the formation of a soluble anionic species in which the ratio of rare earth metal ion to triphosphate is 1:2. Solution of rare earth pyrophosphates in excess of pyrophosphate can also be effected. Elution of these rare earths from a typical cation exchange agent (Amerlite IR-120) with triphosphate at pH of 8.5 affords additional evidence for formation of the bis-triphosphato rare earth complex. Large ratios of pyrophosphate to rare earth are needed to effect elution with pyrophosphate. The absorption spectrum of a solution of the bis-triphosphato neodymium complex differs only slightly from that of an aqueous neodymium chloride solution. (auth)

13801

ZEEMAN EFFECT DATA FOR THE SPECTRA OF ERBIUM. John W. Lindner and Sumner P. Davis (Massachusetts Inst. of Tech., Cambridge). J. Opt. Soc. Am. 48, 542-7(1958) Aug.

Zeeman effect data have been collected for 18 resolved patterns in the Er I spectrum, 201 resolved patterns in the Er II spectrum, and 205 unresolved patterns. The use of digital computers in the analysis of spectra is discussed and applied, in an attempt to break into term arrays of the erbium spectra. The electrodeless discharge source unit that was used is described. (auth)

13802

THE MAGNETIC FIELD AT THE NUCLEUS OF Sm^{+++} INDUCED BY PARAMAGNETISM OF 4f-ELECTRONS.

Junjiro Kanamori and Kenzo Sugimoto (Osaka Univ.). J. Phys. Soc. Japan 13, 754-5(1958) July.

Calculation of the electronic magnetic moment of Sm^{3+} is discussed. Assuming that the nucleus interacts with a thermal average of the electronic magnetic moment, the thermal average of the interaction between the nucleus and the 4f electrons over the electronic states is taken. (J.R.D.)

13803

THE SPECIFIC HEATS OF GADOLINIUM AND TERBIUM BETWEEN 0.2°K AND 6°K. N. Kurti and R. S. Safrata (Clarendon Lab., Oxford). Phil. Mag. (8) 3, 780-3(1958) July.

Ingots of pure gadolinium and terbium weighing about 20 g each were used in the determination of their specific heats from 0.2 to 6°K. (J.R.D.)

13804

THE PREPARATION AND PROPERTIES OF EUROPIUM. F. H. Spedding, J. J. Hanak, and A. H. Daane (Iowa State Coll., Ames.). Trans. Met. Soc. AIME 212, 379-83(1958) June.

A quantity of 70.4 g of europium metal of high purity was prepared by heating Eu_2O_3 with lanthanum metal in vacuo at 1200°C. The properties determined are listed. Vapor pressure was determined as a function of temperature. The data were fitted to a straight line, yielding the formula $\log P_{mm} = (-8982 \pm 16)/T - (8.160 \pm 0.027)$. The other properties determined are as follows: melting point, 826 ± 10°C; boiling point (calculated), 1489°C; lattice constant at 298°C (bcc lattice), 4.5820 ± 0.0004 A; density at 298°K (calculated), 5.245 g/cm^3; heat of sublimation at 298°K, 42,066 ± 75 (calculated); compressibility at 300°K, 6.99×10^{-6} cm^2/kg; electric resistivity at 298°K, 81.3×10^{-6} ohm-cm; temperature coefficient of electrical resistance at 298°K, 0.00480 (°C)$^{-1}$; coefficient of linear thermal expansion, 26×10^{-6}(°C)$^{-1}$; change of volume on melting, +4.8%. Europium reacts rapidly in moist air, following a linear low, $Eu(OH)_2 \cdot H_2O$ resulting. (auth)

13805

CO-PRECIPITATION OF LANTHANUM, CERIUM AND AMERICIUM WITH POTASSIUM SULFATE. V. I. Grebenshchikova and V. N. Bobrova. Zhur. Neorg. Khim. 3, 40-5(1958). (In Russian)

In the coprecipitation of La, Ce, and Am with K_2SO_4, it was shown that the ions not only coprecipitated but that they also are adsorbed by crystalline deposits. Therefore, adsorption and crystallization were investigated separately. The specific surface of the adsorbent was calculated, and it was found that the quantity adsorbed increases with the concentration of the elements in the solution. The adsorption is not affected by the presence of foreign ions. From the study of the cocrystallization it appears that La, Ce, and Am are carried in the interior of the potassium sulfate crystal and distributed there. It is concluded that these elements form anomalous mixed crystals not having a lower boundary of miscibility. (J.S.R.)

13806

THE THEORY OF THE SEPARATION OF RARE EARTHS BY MEANS OF CHROMATOGRAPHICAL METHODS. N. N. Tunitskii, V. V. Nekrasov, and E. P. Cherneva. Zhur. Neorg. Khim. 3, 66-73(1958). (In Russian)

The results of the application of statistical methods to the theory of the separation of rare earths by chromatographic methods are described. Theoretical results are compared with experimental data. (J.S.R.)

13807

THE CHROMATOGRAPHIC SEPARATION OF THE RADIOISOTOPES OF THE ELEMENTS OF RARE EARTHS BY MEANS OF ION EXCHANGE. A. K. Lavrukhina, F. I. Pavlotskaya, A. A. Pozdnyakov, and I. M. Grechishcheva. Zhur. Neorg. Khim. 3, 82-7(1958). (In Russian)

The chromatographic separation of rare earths formed by nuclear transformations with high-energy particles is discussed. Special attention is given to the effect of the quantity of the elements on the degree of separation and to the position of the maximum of the chromatographic curve. (J.S.R.)

13808

THE APPLICATION OF ION EXCHANGE IN THE INVESTIGATION OF THE STATE OF THE SUBSTANCE IN SOLUTION. IV. THE INVESTIGATION OF THE COMPLEX-FORMATION OF YTTRIUM WITH LACTIC ACID BY MEANS OF THE METHOD OF "ABSORPTION-CURVES." V. I. Paramonova, A. N. Mosevich, and A. I. Subbotina. Zhur. Neorg. Khim. 3, 88-94(1958). (In Russian)

The formation of yttrium complexes with lactic acids was studied by adsorption of the complex on cation resins. A tracer technique was used. (J.S.R.)

13809

THE SEARCH FOR PROMETHIUM IN NATURE. A. K. Lavrukhina. Zhur. Neorg. Khim. 3, 129-35(1958). (In Russian)

The principles to be used in the search for radioisotopes in nature are discussed, and the application of these to the search for promethium is described. A methodical plan for the detection of promethium in nature was devised and tested on prepared samples. (J.S.R.)

13810

THE STATE OF MICRO QUANTITIES OF PROMETHIUM IN AQUEOUS SOLUTIONS. I. E. Starik and M. S. Lambet. Zhur. Neorg. Khim. 3, 136-8(1958). (In Russian)

The adsorption of Pm on quartz glass was investigated as a function of pH at a concentration of 10^{-10} mole. By means of ultrafiltration it was shown that the Pm is in the solution in colloidal form. It was established that there was a definite adsorption maximum at pH 6.2. (J.S.R.)

13811

CERIUM EXTRACTION WITH TRIBUTYL-PHOSPHATE. A. V. Nikolaev, A. A. Sorokina, and A. S. Maslennikova. Zhur. Neorg. Khim. 3, 160-4(1958). (In Russian)

It was shown that the extraction of cerium with TBP is determined by the reduction of cerium and its equilibrium distribution. The presence of other rare earth elements does not affect the extraction. A method for the production of cerium from raw materials is described. About 93 to 98% of the cerium can be obtained by this method with a purity of 98%. (J.S.R.)

13812

ON CERIUM HYDRIDES. V. I. Mikheeva and M. E. Kost. Zhur. Neorg. Khim. 3, 260-8(1958) Feb. (In Russian)

Experiments on cerium hydridation were made with prepared cerium with admixtures of < 0.001% Cu, 0.037% Fe, 0.03% Mg, 1.8% Nd, 0.001% Pb, 1.1% Pr, 0.015% S, and 0.02% Si. Absorption of hydrogen reaches up to $CeH_{2.15}$. Hydrides of alternating compositions and stoichiometric hydrides CeH_3 and CeH_2 were observed.

The cerium hydride is stable up to 200°C; with further heating it decomposes by hydrogen liberation and forms CeH_2. CeH_2 melts at 1080°C; melting is followed by decomposition. The existence of CeH_3 is confirmed by the synthesis of double hydrides from $Ce(AlH_4)_3$. (R.V.J.)

13813

COMPLEX FORMATION OF TETRAVALENT CERIUM WITH ACETATE AND OXALATE IONS. II. RECOVERY OF CERIUM FROM NITRIC ACID. N. S. Vagina (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Zhur. Neorg. Khim. 3, 1366-9(1958) June. (In Russian)

Nitric acid salt solutions of rare earth elements were used for the recovery of cerium complexes with acetate and oxalate ions from a mixed cerium group. Advantages of hydroxides of rare earths in the recovery process are given. The principle factor affecting the complete recovery of cerium is the presence of a high content of cerium in oxide form, which in turn depends upon the method of preliminary oxidation and reduction into solutions. (R.V.J.)

13814

LANTHANUM ACETATE PENTAHYDRATE. V. N. Maksimov and K. N. Semenenko. Zhur. Neorg. Khim. 3, 1468-9(1958) June. (In Russian)

Lanthanum acetate pentahydrate crystals were prepared by slow crystallization of an aqueous solution of lanthanum acetate at temperatures below 18 to 20°C. The crystal structure and thermal stability of the compound were measured. (R.V.J.)

Separation Procedures

Refer also to abstracts 13811, 14391, 14392, 14393, 14394, 14395, 14396, 14397, 14398, 14399, 14400, 14401, 14402, 14404, 14408, 14410, 14411, 14412, 14414, 14415, 14416, 14417, 14418, 14419, and 14420.

13815 AECD-3744

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

RECOVERY OF ZIRCONIUM TETRACHLORIDE POWDER. L. A. Lee and M. A. Welt. Aug. 6, 1956. Decl. Aug. 11, 1958. 20p. For Union Carbide Nuclear Co. [K-25 Plant, Contract W-7405-eng-26, Subcontract 70]. (KT-226). $3.30(ph OTS); $2.40(mf OTS).

The Zircex Process for the recovery of zirconium from zirconium clad fuel elements is presented. Various types of apparatus were investigated for desublimation and collection of the solid zirconium tetrachloride. Of primary importance is the determination of particle size and distribution of the $ZrCl_4$ condensed for, in general, the larger and more uniform the particle size, the easier the collection. (W.L.H.)

13816 CF-57-6-87(Rev.)

Oak Ridge National Lab., Tenn.

EXPERIMENTS ON THE RELEASE OF FISSION PRODUCTS FROM MOLTEN REACTOR FUELS. George W. Parker and George E. Creek. Mar. 11, 1958. 22p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Experiments in the controlled melting of irradiated fuel specimens, particularly of the APPR, STR, and MTR types, have confirmed that prolonged heating in air at temperatures in excess of the melting point results in the release of a large portion of the radioactivity. On the other hand, a moderate amount of heating in air or steam sufficient only to melt a specimen results mainly in the partial volatilization of rare gases, iodine, bromine, cesium, and rubidium. In the presence of air or water vapor, strontium and other fission products are not released. At trace concentration of fission products, slow melting of the APPR plate at 1525°C in air or steam effected the release of 50% of the rare gases, 33% of the iodine, 9% of the cesium, and traces of strontium. After 25% burn-up, the cesium value increased to about 60%. Aluminum alloy of the MTR type, also at trace concentration, upon melting at 700°C released up to 2% of the iodine, 10% of the rare gases, and negligible portions of other fission products. Zirconium alloy of the STR type after 15% burn-up, when melted at 1850°C, released up to 95% of the rare gases, 90% of the cesium, 60% of the iodine, and only a trace of strontium. (auth)

13817 CF-58-3-8

Oak Ridge National Lab., Tenn.

HYDROCLONE PERFORMANCE IN THE SOLVENT RECOVERY SYSTEM OF THE THOREX PILOT PLANT. J. Cerny, III. Mar. 31, 1958. 23p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Tests on 1-gpm and 0.5-gpm hydroclones showed them to be unnecessary. Solvent-aqueous phase separation, although effective when optimized, was infrequently required. The 1-gpm hydroclone produced better water separation than the 0.5-gpm hydroclone for similar control parameters. Decontamination factors for widely varying flow conditions ranged from 1 to 3. Introduction of water into the hydroclone feed stream had no effect on decontamination or particle removal. (auth)

13818 CF-58-8-36

Oak Ridge National Lab., Tenn.

A CHEMICAL ENGINEERING DEVELOPMENT PROGRAM—AN INVESTIGATION OF THE KINETIC MECHANISMS OF URANYL SALT ION EXCHANGE. S. H. Jury. Aug. 11, 1958. 17p. Contract [W-7405-eng-26.] $3.30 (ph OTS); $2.40(mf OTS).

Recent literature concerning uranyl salt complex chemistry and ion exchange was reviewed in an effort to develop the present state of understanding of the equilibria and kinetic mechanisms involved. In the light of this, a development program is discussed which hopefully would lead to further enlightenment. Various kinetic mechanisms of sorption and elution are proposed and a comprehensive mathematical development is given for one such sorption mechanism. (auth)

13819 NAA-SR-2543

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

RADIATION INTENSITIES ASSOCIATED WITH CHEMICAL PROCESSING OF METALLIC URANIUM FUEL. Sheldon Berger. July 1, 1958. 32p. Contract AT-11-1-GEN-8. $1.00(OTS).

Radiation intensities were calculated for a 50-kg charge of irradiated and unprocessed fuel in the oxide-drossing crucible, a 50-kg processed ingot, an in-cell roughing filter, and the gas-handling system silica-gel adsorption trap for collecting Xe and Kr. The thermal power of β-γ activity in irradiated 10-day cooled, unprocessed fuel is calculated to be 11.7 watts per kg. Over 75% of this thermal power remains in the oxide-drossing crucible as a residue after processing. This residue has a thermal power of 8.2 watts per kg of fuel processed. After successive melts, this continues to build up and the thermal power may exceed 2000 watts after ten melts. For fuel which has undergone a burn-

up of 3000 Mwd/t and a cooling period of 10 days, a gamma decontamination factor of two is calculated in processing of metallic uranium. This is due to the fact that a large percentage of the gamma activity is contributed by Zr, Nb, Mo, and Ru which remain with the uranium after processing. (auth)

13820 NP-6862

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

THE USE OF SODIUM BISULPHATE FOR TREATING URANIUM ORE. K. Pinkas. Mar. 1958. 6p.

Investigations were carried out to determine the optimum conditions of treating ore roasted in the presence of sodium bisulfate by means of alkaline solution. It was found that the amount of uranium extracted increased to 94% when the ore containing 20% sodium bisulfate was roasted at 600°C and after that leached with solution containing 7% sodium carbonate and 7% sodium bicarbonate at 70°C for five hours. (auth)

13821 TID-5227

Columbia Univ., New York. Substitute Alloy Materials Labs.

SEPARATION OF THE BORON ISOTOPES. George M. Murphy, ed. 1952. Decl. Feb. 27, 1957. 469p. Contracts OEMsr-412 and W-7405-eng-50. (NNES-III-5). $7.00 (OTS).

The need for a large quantity of crystalline boron, including a quantity containing at least 90% B^{10}, required preparatory study of materials and methods. The results of this preliminary work are described. In the method finally chosen, the isotopic separation occurred in the distillation of dimethyl ether–BF_3 complex, the B^{10}-enriched complex then being converted to $CaF_2 \cdot BF_3$ from which the BF_3 was liberated by heating. The BF_3 was then converted to BCl_3 by passage through $AlCl_3$, the chloride being subsequently reduced to crystalline boron by hydrogen on heated rods. The various processes and apparatus used are described in detail and data are included on the physical properties of substances used in connection with the research. (W.L.H.)

13822 WIN-58

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

AMENABILITY TESTING OF ORES FROM KARNES COUNTY AND ADJACENT AREAS IN TEXAS. D. R. George and J. T. Lynch. June 23, 1958. 31p. Contract AT(49-6)-924. $6.30(ph OTS); $3.00(mf OTS).

The amenability testing of the highly bentonitic ores from Karnes County is reported. The results of acid leaching tests on four miscellaneous samples from Karnes, Gonzales, and Duval Counties and information on acid leaching and physical beneficiation of two low-grade samples from Atascosa County are included. (auth)

13823 WIN-84

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

ALKALINE LEACH–CCD–COLUMN ION EXCHANGE PILOT PLANT TESTING OF AMBROSIA LAKE ORES. H. L. Ford, J. R. Ruark, and R. L. Shimmin. June 16, 1958. 54p. Contract AT(49-6)-924. $9.30(ph OTS); $3.60(mf OTS).

Upon approval of the Raw Materials Division of the U. S. Atomic Energy Commission, Rio de Oro Dysart Shaft ore and a blend of Holly Minerals Company ore from the Ambrosia Lake area of New Mexico were treated in the Alkaline Leach–CCD–Column Ion Exchange Pilot Plant at Ground Junction, Colorado. The tests were made to continue development of the alkaline leach–CCD–column ion exchange process, to determine the amenability of the two ores to such a process and to obtain design data for possible commercial application. (auth)

13824 WIN-98

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

LABORATORY INVESTIGATION OF MALLINCKRODT BOMB LINEAR SLAG. E. S. Porter. June 13, 1958. 50p. Contract AT(49-6)-924. $7.80(ph OTS); $3.30(mf OTS).

Data are given for leaching Mallinckrodt magnesium fluoride and dolomite slag in acid and alkaline systems. Recovery of dissolved values is considered using direct precipitation, ion exchange, or solvent extraction. (auth)

13825 WIN-107

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

ALKALINE LEACH–FILTRATION PILOT PLANT TESTING OF HOMESTAKE ORE–SECTION 32. H. E. Dixon and G. Winslow. June 19, 1958. 33p. Contract AT(49-6)-924. $6.30(ph OTS); $3.00(mf OTS).

Homestake Ore from the Ambrosia Lake District of New Mexico was treated in the Alkaline Leach–Filtration Pilot Plant at Grand Junction, Colorado. Detailed information on grinding, leaching, filtration, and precipitation in connection with the processing of this ore is given. Autoclave leaching and continuous yellow cake precipitation were employed. The circuit liquors contained organic material that was detrimental to clarification and precipitation and the results show that the ore was amenable to the Alkaline Leach–Filtration process only if a special additive was used. (auth)

13826 IGRL-T/CA-70

THEORY OF THE CASCADE FOR THE SEPARATION OF BINARY MIXTURES OF ISOTOPES. O. K. Davtyan. Translated by E. G. Peters (U.K.A.E.A. Industrial Group, Risley) from Zhur. Fiz. Khim. 31, 283-90(1957). 12p.

The fundamental principle is given of the rational (or ideal) cascade for the separation of binary mixtures of isotopes. This principle underlies the entire theory of the rational cascade for the separation of binary mixtures by all possible physical methods. A relationship is presented connecting the effective and ideal enrichment coefficients. A general equation has been derived for determining the number of stages in the cascade at any value for the separation factor. The result of the action of natural diffusion on the flow cycle has been demonstrated. An equation has been proposed for the flow cycle compensating the diffusion transfer. An equation for the rational cascade flow has been presented. The equation is general, permitting calculation of the flow for each stage with any value of the separation factor, employing any physical method for the separation. A particular case of this equation, when the separation factor is considerably below unity ($\varepsilon \ll 1$) is Cohen's equation. The theory which is developed holds good for any value of the separation factor and is applicable equally well to all methods of separating binary mixtures of isotopes. (auth)

13827

INDIVIDUAL FILM COEFFICIENTS OF MASS TRANSFER IN LIQUID-LIQUID EXTRACTION. G. C. Smith and R. B. Beckmann (Carnegie Inst. of Tech., Pittsburgh). A.I.Ch.E. Journal 4, 180-9(1958) June.

A study has been made of the individual film coef-

ficients of mass transfer for two binary liquid-liquid systems of differing physical properties, namely methyl isobutyl carbinol–water and methylethyl ketone–water, in a 4-in.-diam. extraction column operated as a spray column and with ½-in. Raschig ring packing. The value of H_t for the dispersed phase was found to be a constant, C_1, for a given system in a given column. The H_t values for the continuous phase could be correlated by the equation, $(H_t)_c = C_2(V_c/V_d)^n$. Values of the constants C_1, C_2, and n are tabulated along with the values found by earlier investigators for other systems and column packings. The H_t values have been reduced to area base coefficients by the expression for droplet surface area proposed by Gaylor and Pratt (Trans. Inst. Chem. Engrs. (London) 31, 69(1953)). Presaturation of either phase was found to have no effect on mass transfer rates. There appears to be relatively little difference in the efficiency of spray and packed columns for systems of low interfacial tension, but for high interfacial-tension systems packed columns are considerably more efficient than spray columns. While no definitive correlations for the effect of physical properties are proposed, there are some indications that n is a function of the viscosity ratio of the two liquid phases and that C_2 is a function of the ¼ power of the groups $(d\Delta\rho\gamma/\mu^2_c)(\mu_c/\mu_d)$ and $(N_{Sc})_c$. No correlation was found for the effect of physical properties on $(H_t)_d$. (auth)

13828

ESTIMATION OF THE STAGE EFFICIENCY OF SIMPLE, AGITATED VESSELS USED IN MIXER-SETTLER EXTRACTORS. Robert E. Treybal (New York Univ.). A.I.Ch.E. Journal 4, 202-7(1958) June.

A method of calculation is presented by which estimates may be made of the stage efficiency of continuously operated, agitated, baffled vessels used in mixer-settler extractors. The calculations are limited to cases where the agitating impeller is a flat-blade turbine, and do not include estimates of the entrance and exit effects. The method has been tested with all the available experimental data, which include three different sizes of vessels, systems, and impeller sizes, and a variety of operating conditions including speeds of agitation, rates of flow, and ratios of contacted liquids. (auth)

13829

ION-EXCHANGE SEPARATION OF FISSION PRODUCTS. Eiiti Minami, Masatake Honda, and Yukiyoshi Sasaki (Univ. of Tokyo). Bull. Chem. Soc. Japan 31, 372-7(1958) Apr.

Studies were made to find a systematic separation method for fission products, taking into account the minor constituents distributed in the "trough" region of the fission yield-mass curve. The ion exchange behavior of the individual elements was first studied. A possible ion exchange separation process for a fission product mixture is given. (J.S.R.)

13830

TRI-n-BUTYL PHOSPHATE AS AN EXTRACTING SOLVENT FOR INORGANIC NITRATES. V. FURTHER RESULTS FOR THE TETRA- AND HEXAVALENT ACTINIDE NITRATES. K. Alcock, G. F. Best, E. Hesford, and H. A. C. McKay (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 6, 328-33(1958) July.

Partition coefficients were determined (some in earlier papers in this series) for (Th, Np, Pu)$(NO_3)_4$ and (U, Np, Pu)$O_2(NO_3)_2$ at trace concentrations in presence of nitric acid, between a tri-n-butyl phosphate (TBP) and an aqueous phase. All are strongly extracted, and all appear to form di-solvates, $M(NO_3)_4 \cdot 2TBP$ and $MO_2(NO_3)_2 \cdot 2TBP$. Extraction generally increases in the order Th < Np(IV) < Pu(IV), but the series U(VI) > Np(VI) > Pu(VI) shows the reverse trend. (auth)

13831

THE EXTRACTION OF URANYL NITRATE FROM NITRIC ACID SOLUTIONS BY TRIBUTYL PHOSPHATE. Taichi Sato (Gov't. Chemical Industrial Research Inst., Tokyo). J. Inorg. & Nuclear Chem. 6, 334-7(1958) July.

The effects of nitric acid concentration, uranyl nitrate concentration, and temperature were investigated in order to determine the optimum conditions for the extraction of uranyl nitrate from nitric acid solutions by TBP. It is apparent from the results that greater than 97% extraction is obtained when uranyl nitrate solution of less than 10 g/l concentration and containing 6 M HNO_3 is extracted with 19% TBP in kerosene at a temperature of less than 20°C. (auth)

13832

URANIUM EXTRACTION BY DI-n-DECYLAMINE SULFATE. W. J. McDowell and C. F. Baes, Jr. (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 62, 777-83(1958) July.

The extraction of uranium from sulfuric acid–sodium sulfate solutions by di-n-decylamine sulfate in benzene is examined as a function of uranium, amine, acid, and sulfate ion concentration. The stoichiometry of the principal organic complex is uranium : sulfate : amine = 1 : 4 : 6. The dependence of uranium extraction on total uranium concentration and on extractant concentration is disucssed in terms of the extensive association of di-n-decylamine sulfate in the organic phase. Data for variation of sulfate ion concentration are shown to be consistent with formation quotients of aqueous UO_2SO_4 and $UO_2(SO_4)_2^{=}$ to be found in the literature. No evidence was found for the formation of a $UO_2(SO_4)_3^{=4}$ complex. (auth)

13833

THE ENRICHMENT OF THE RARE CARBON ISOTOPE BY A CHEMICAL METHOD. Yu. K. Shaposhnikov. Zhur. Fiz. Khim. 32, 869-74(1958) Apr. (In Russian)

The isotope exchange reaction between CO_2 and an aqueous solution of monoethanolamine bicarbonate was used for the enrichment of the rare carbon isotope. The radioactive isotope C^{14} was used as indicator. Monoethanolamine bicarbonate was decomposed by simply boiling in a boiler. Activated carbon and silica gel were employed in the exchange column as fillers. The effect of the monoethanolamine bicarbonate concentration and of the temperature in the exchange column on the separation factor was established. Maximum separation of the carbon isotope was attained at a temperature in the exchange column of 20° with a 0.9 to 1.0 M solution of the bicarbonate. Carbonic anhydrase was used to increase the exchange reaction, its addition to the bicarbonate solution increasing the separation factor of the column and lowering the time required to attain equilibrium in the column at equal concentrations of the products. The addition of carbonic anhydrase to the solution in operation lowers the CO_2 solubility in the boiling monoethanolamine, making for complete return of the CO_2 to the column. A similar effect is observed on adding ethyl alcohol to the solution. (tr-auth)

13834

THE METHODS OF ISOLATION OF RADIOPHOSPHORUS FROM CHLORINE AND SULFUR CONTAINING

TARGETS. A. I. Korshunov and A. I. Shafiev. Zhur. Neorg. Khim. 3, 100-3(1958). (In Russian)

The method of isolation of P^{32} without carrier from CCl_4, $CHCl_3$, S_2Cl_2, NH_4Cl, $MgCl_2$, $CaCl_2$, Na_2SO_4, $Na_2S_2O_3$, and KCNS was investigated. Electrodeposition and adsorption methods were studied, and the optimum conditions for each are described. (J.S.R.)

13835

ON SOME CHARACTERISTIC FEATURES OF THE CHROMATOGRAPHIC SEPARATION OF MIXTURES OF RADIOACTIVE SUBSTANCES. M. M. Senyavin, G. M. Kolosova, and V. A. Nikashina. Zhur. Neorg. Khim. 3, 104-8(1958). (In Russian)

The general problems and characteristics of the chromatographic separation of mixtures of radioactive substances were investigated. The static and kinetic properties of the process are discussed. (J.S.R.)

13836

A NEW METHOD FOR THE RADIOCHEMICAL PURIFICATION OF PROTACTINIUM. I. E. Starik and L. D. Sheidina. Zhur. Neorg. Khim. 3, 139-44(1958). (In Russian)

An investigation was made to find a simple method for the radiochemical purification of Pa without the use of hydrofluoric acid. Precipitation with phthalic acid, phenylarsonic acid, and mandelic acid was tested. The first two reagents coprecipitate polonium. Mandelic acid allows a rapid and accurate determination with a precision of 5 to 10%. The precipitation with mandelic acid also assures a high degree of purity of Pa from all other radioisotopes. (J.S.R.)

13837

EXTRACTION AS A METHOD OF SEPARATION AND INVESTIGATION OF RADIOACTIVE ELEMENTS. V. M. Vdovenko. Zhur. Neorg. Khim. 3, 145-54(1958). (In Russian)

A review is presented on the extraction methods used in radiochemistry. 34 references. (J.S.R.)

13838

A METHOD FOR THE EXTRACTION OF TECHNETIUM FROM IRRADIATED MOLYBDENUM. M. S. Faddeeva, O. N. Pavlov, and V. V. Bakunina. Zhur. Neorg. Khim. 3, 165-6(1958). (In Russian)

A method is given for the extraction of technetium from irradiated molybdenum with methylethyl ketone. Optimum results were obtained using KOH, K_2CO_3, and $(NH_4)_4CO_3$ as salting-out agents. A high molybdenum content decreases the efficiency of potassium and ammonium hydroxides. (J.S.R.)

13839

THE ISOLATION OF RADIOACTIVE ISOTOPES WITHOUT CARRIERS. N. P. Rudenko. Zhur. Neorg. Khim. 3, 167-74(1958). (In Russian)

A survey is given of the methods used for the isolation of radioisotopes without carriers. The methods used in the Research Institute for Nuclear Physics of the Moscow State University are discussed in detail. 18 references. (J.S.R.)

13840

USE OF CARBONYLS FOR THE ISOLATION OF THE RADIOISOTOPES Cr^{51}, Mo^{99}, W^{187}, Tc^{99m}, AND Re^{188}. V. D. Nefedov and M. A. Toropova. Zhur. Neorg. Khim. 3, 175-80(1958). (In Russian)

The carbonyls of Cr, Mo, and W were used as irradiation products since the carbonyls are easily purified and resistant to irradiation. After a short irradiation, the crystals were dissolved in chloroform and the isotopes extracted with water. The yields were 30, 34, and 55% for W, Mo, and Cr, respectively. The use of carbonyls for the separation of Tc^{99m} and Re^{188} was also investigated. Both isotopes were obtained without carrier and were radiochemically pure. (J.S.R.)

13841

THE SEPARATION OF THE NUCLEAR ISOMERS OF TELLURIUM, MERCURY AND TIN. A. N. Murin, V. D. Nefedov, E. N. Sinotova, and O. V. Larionov. Zhur. Neorg. Khim. 3, 181-3(1958). (In Russian)

Methods for the separation of the isomers of tellurium, mercury, and tin were investigated. Metalloörganic compounds were prepared, and as a result of isomeric transitions the chemical bonds were broken. The isomers in the ground state formed simple inorganic compounds and were removed. (J.S.R.)

13842

ISOLATION OF TECHNETIUM-99m WITHOUT CARRIER BY MEANS OF BREAKING CHEMICAL BONDS DURING β-DECOMPOSITION. V. D. Nefedov and M. A. Toropova. Zhur. Neorg. Khim. 3, 231-4(1958). (In Russian)

A new method for the isolation of carrier-free Tc^{99m} by extraction from chloroform solution of $Mo/Mo^{99}/(Co)_6$ is described. The possibility of applying this method to the isolation of other radioisotopes is discussed. (J.S.R.)

13843

THE ADVANTAGES OF CONTINUOUS ANALYZERS IN A PILOT PLANT. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 161, Session 34. C. L. Pleasance (General Electric Co.). New York, American Institute of Chemical Engineers, 1958. 22p.

Twenty-nine continuous analyzers were installed at key points in a radiochemical pilot plant. These analyzers included gross gamma monitors, a gamma spectrometer, turbidimeters, colorimeters, pH monitors, gamma absorptiometers, polarographs, and a low-level alpha counter. The analyzers proved valuable in indicating the approach to equilibrium in the process, in showing immediately how a change in one or more of the process variables affect the process dynamics, and in detecting process upsets or malfunctions of process equipment. (auth)

Sorption Phenomena

Refer also to abstract 13868.

13844 CF-58-7-71

Oak Ridge National Lab., Tenn.

EVALUATION OF FISSION GAS ADSORPTION TRAPS FOR ORNL-MTR-44 LOOP EXPERIMENT. R. E. Adams and W. E. Browning. July 18, 1958. 15p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

A method of predicting the performance of fission gas adsorption traps containing activated charcoal is presented. This method is applied in the evaluation of the fission gas traps designed for use in the ORNL-MTR-44 loop experiment. The method should also be applicable in evaluating fission gas traps contained in other reactor experiments. (auth)

13845

ADSORPTION OF NITROGEN VAPORS ON GRAPHITIZED CARBON BLACK AND COAL. A. V. Kiselev and E. V. Khrapova. Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk No. 4, 389-401(1958) Apr. (In Russian)

Adsorption of nitrogen vapors was studied on initial and graphitized carbon black and coal, and the results were compared with data on the adsorption of argon, krypton, and methane. Calcination of carbon black at 1700°C in a hydrogen flux reduces the roughness of the surface and makes the material more uniform. (R.V.J.)

13846

THE ANION-EXCHANGE RESIN ADSORPTION OF ZINC(II) FROM AMINE-CHLORIDE SOLUTIONS. R. A. Horne (Massachusetts Inst. of Tech., Cambridge). J. Phys. Chem. 62, 873(1958) July.

The adsorption of Zn^{2+} on Dowex 1-X^8 chloride from amine-chloride solutions was measured at 25°C and compared with adsorption from a titramethylammonium chloride 50 vol% ethanol–water solution. The results are plotted and discussed with respect to the theory of metal complex adsorption from aqueous solutions by anion exchange resins. (D.E.B.)

13847

THE ION EXCHANGE AND SORPTION OF RADIOELEMENTS. B. P. Nikol'skii. Zhur. Neorg. Khim. 3, 59-65(1958). (In Russian)

A review is given of the ion exchange and sorption behavior of radioelements. The use of ion exchange in radiochemistry is discussed. 23 references. (J.S.R.)

13848

SORPTION OF RADIOACTIVE ISOTOPES BY ALUMINUM HYDROXIDE. S. A. Voznesenskii, V. V. Pushkarev, and V. F. Bagretsov. Zhur. Neorg. Khim. 3, 235-9(1958). (In Russian)

The sorption of Cs^{137}, Sr^{89}, Sr^{90}, Ce^{144}, and Ru^{106} on aluminum hydroxide was studied. The sorption of Sr, Ce, and Ru reached a maximum which was determined by the pH value: 7.0 for Ru, 7.5 for Ce, and 9.0 for Sr. Cs was not adsorbed under all test conditions. Ru and Ce were adsorbed with a positive charge, and Sr with a negative charge. (J.S.R.)

Spectroscopy

13849

SCATTERED X-RAYS AS INTERNAL STANDARDS IN X-RAY EMISSION SPECTROSCOPY. George Andermann and J. W. Kemp (Applied Research Labs., Glendale, Calif.). Anal. Chem. 30, 1306-9(1958) Aug.

Instrumental variables and absorption effects in x-ray emission spectroscopy are corrected for by use of scattering radiation of the sample as an internal standard. Correction is complete or partial depending upon the immediate analytical problem. (auth)

13850

RAMAN DIFFUSION SPECTRUM OF LITHIUM HYDROXIDE MONOHYDRATE CRYSTALS. Elisabeth Drouard. Compt. rend. 247, 68-70(1958) July 7. (In French)

The lines observed in the Raman spectrum of $LiOH \cdot H_2O$ are given. The coefficients for the polarizability tensors, derived from the lines attributed to the OH elongation vibration and to the vibrations of the water molecule, are in agreement with the hypotheses based on the location of the hydrogen atoms. (tr-auth)

Syntheses

13851

SYNTHESIS OF GRAFTED COPOLYMERS BEGINNING WITH POLYMERS BEING EXPOSED TO IONIZING RADIATIONS. I. GENERAL CHARACTERISTICS OF THE GRAFTING REACTION ON THE PREIRRADIATED POLYETHYLENE. Adolphe Chapiro (Laboratoire de Chimie Physique, Paris). J. Polymer Sci. 29, 321-42 (1958) June. (In French)

When polyethylene is irradiated in the presence of air, peroxydic crosslinks are formed besides the formation of polymeric networks. These peroxydic crosslinks were used for preparing graft copolymers. Previously irradiated polyethylene sheets were heated at different temperatures in a vinyl monomer (acrylonitrile, methyl methacrylate, vinylcarbazole). It was stated that in these conditions the sheets grow in the reaction medium at very high grafting yields (corresponding to a final weight exceeding by a hundred times the initial weight). During this growth, the external shape of the sheets was maintained. The kinetics of these reactions at temperatures between 25 and 192° was studied. The activation energy varied with the grafting temperature. For grafting acrylonitrile E = 9.3 kcal was found above 109° and 17.4 kcal below that temperature, while for methyl methacrylate the values were, respectively, equal to 8.6 and 16.2 kcal above and below 9°. This phenomenon was interpretated by observing that below 100 to 110° the polyethylene contains crystallines zones which oppose the free diffusion of the monomer; as a result, a temperature depending term must be considered, corresponding to the activation energy of diffusion. Above 110°C the crystallites are entirely melted and the monomer diffuses freely in the amorphous polymer. At 25° the grafting is extremely low. This permits stocking of the polymer during very long periods (about one year) without any appreciable decrease of activity toward grafting. (auth)

13852

SYNTHESIS OF GRAFTED COPOLYMERS BY THE ACTION OF IONIZING RADIATION ON SOLUTION OF POLYISOBUTYLENE IN STYRENE. Jeanne Sebban-Danon (Laboratoire de Chimie Physique, Paris). J. Polymer Sci. 29, 367-74(1958) June. (In French)

The radiochemical polymerization of styrene in the presence of polyisobutylene was studied. The polymerization of styrene was initiated with radicals from styrene and from polyisobutylene. The initiation reactions produced, respectively, polystyrene and the graft copolymer of polystyrene on polyisobutylene. The influence of the radiation intensity and the influence of the initial concentration of polyisobutylene on the reaction kinetics were studied. (auth)

13853

ORGANIC SYNTHESES WITH ISOTOPES. PART I. COMPOUNDS OF ISOTOPIC CARBON. Arthur Murray, III and D. Lloyd Williams. New York, Interscience Publishers, Inc., 1958. 1154p.

Labeling syntheses of organic compounds published through 1955 are presented in an encyclopedic form. The procedures are detailed for use directly in the laboratory. The carbon-labeled compounds are arranged as to type of compound (i.e., acid, amine, ether, hydrocarbon) and, within types, by increasing complexity. (T.R.H.)

Tracer Applications

13854

DETERMINATION OF THE HYDROXYLIC SURFACE BY ISOTOPIC EXCHANGE. José Fripiat and Marie-Claire Gastuche (Univ. of Louvain, Belgium). Bull. soc. chim. France No. 5, 626-35(1958) May. (In French)

The method described, useful in the case of powders, consists of measuring the variation in composition of a mixture of light and heavy water circulating in the vapor state over the sample. The apparatus, capable of an absolute precision of 0.05%, is described. The final result, surface hydroxyl groups per unit weight, is reproducible within a few percent. The values calculated for kaolinite agree with the experimental values reasonably well. (T.R.H.)

Transuranic Elements and Compounds

Refer also to abstract 14409.

13855 HW-55778

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TRANSFORMATION KINETICS OF PLUTONIUM. PART I. A STUDY OF THE BETA TO ALPHA AND ALPHA TO BETA TRANSFORMATIONS. R. D. Nelson. Apr. 17, 1958. 26p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The transformation kinetics of alpha and beta plutonium were determined by using a fluid displacement technique. The rate of formation of the alpha phase from the beta phase was determined after beta heat treating and allowing the sample to transform isothermally in the alpha range. Isothermal reaction curves were obtained from −78 to +90°C. A time-temperature-transformation curve showed the maximum rate of transformation to be approximately −20°C. The beta phase did not transform completely to the alpha when the transformation was allowed to take place isothermally. A relationship between the fraction untransformed beta and the transformation temperature has been established. Isothermal reaction curves and a time-temperature-transformation curve of the $\alpha \rightarrow \beta$ transformation were obtained. Portions of the time-transformation curves of the $\beta \rightarrow \alpha$ transformation of four purities were plotted. The effects of beta heat treating times and temperatures were studied. Photomicrographs of a specimen having transformed from the beta to the alpha phase at different rates of transformation are presented. (auth)

13856 LA-473

Los Alamos Scientific Lab., N. Mex.

PREPARATION OF PLUTONIUM METAL BY THE BOMB METHOD. R. D. Baker. June 25, 1946. Decl. Aug. 8, 1958. 63p. Contract [W-7405-eng-36]. $10.80 (ph OTS); $3.90(mf OTS).

The preparation of Pu by bomb reduction of $PuCl_3$ and PuF_4 with Ca in MgO crucibles is described. Good Pu yields were obtained with both chloride and fluoride. (C.W.H.)

13857

RADIOCHEMICAL DETERMINATION OF NEPTUNIUM-239 AND PLUTONIUM-239 IN HOMOGENEOUS REACTOR FUEL AND BLANKET SOLUTIONS. Fletcher L. Moore (Oak Ridge National Lab., Tenn.). Anal. Chem. 30, 1368-9(1958) Aug.

The radiochemical determination of neptunium-239 and plutonium-239 in uranyl sulfate fuel and blanket solutions is based on the carrying of these two isotopes by lanthanum fluoride followed by liquid-liquid extraction of the neptunium-239 with 2-thenoyltrifluoroacetone–xylene. Use of a single container for all separations minimizes losses. (auth)

13858

EXPERIMENTS ON THE PRODUCTION OF THE 102d ELEMENT. G. N. Flerov, S. M. Polikanov, et al. Doklady Akad. Nauk S.S.S.R. 120, 73-5(1958) May 1. (In Russian)

Isotopes of Pu^{239} and Pu^{241} were bombarded by oxygen ions. Ions formed from special source were accelerated to 102 Mev on a 150 cm cyclotron. Energy variations were not over 3%; the ion current was 0.2 to 0.4 μa. The method and scheme for recording α decay are described. The energy spectra of β particles emitted from decayed products in reactions $Pu^{239,241} + O^{16}$ are plotted. Alpha particles with energies <8.5 Mev are emitted by isotopes 102^{251}, 102^{252}, and 102^{253} formed by reactions $Pu^{239}(O^{16}, 4n)102^{251}$, $Pu^{241}(O^{16}, 4-6n)102^{251-253}$. Eighteen α particles with energies >8.5 Mev were recorded in bombardment of Pu^{241} and 8 in case of Pu^{239}. The reaction cross sections were 2×10^{-32} and 5×10^{-33} cm^2, respectively. It was shown that the method used in the experiment can be applied to recording short life α active reaction products with very small yield (cross sections 10^{-32} to 10^{-33} cm^2). (R.V.J.)

13859

A STUDY OF REDOX POTENTIALS OF PLUTONIUM IN NITRIC ACID. P. I. Artyukhin, A. D. Gel'man, and V. I. Medvedovskii (Inst. of Physical Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 120, 98-100(1958) May 1. (In Russian)

Formal redox potentials for various plutonium pairs in nitric acid solutions of various concentrations and the disproportion of Pu(IV) in nitric acid solutions were determined. The redox potentials were measured in a wide range of concentrations of Pu(III) and Pu(IV); formal potentials for Pu(IV)–Pu(III), Pu(VI)–Pu(IV) and Pu(VI)–Pu(III) are tabulated. (R.V.J.)

13860

NOTE ON THE SPECIFIC HEAT OF PLUTONIUM METAL. D. J. Dean, A. E. Kay, and R. G. Loasby (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). J. Inst. Metals 86, 464(1958) June.

Values are reported for the specific heat of plutonium over the range −40° to 550°C and for the latent heats of transformation at the various phase transitions. (auth)

13861

THE ELECTRICAL RESISTIVITY AND THERMAL CONDUCTIVITY OF PLUTONIUM METAL. Thomas A. Sandenaw and Robert B. Gibney (Los Alamos Scientific Lab., N. Mex.). Phys. and Chem. Solids 6, 81-8(1958) July.

The electrical resistivity of two specimens of high-purity plutonium is reported for the temperature range from 26°K to approximately 780°K. These resistivity measurements give further evidence for the six allotropic modifications of solid plutonium found by thermal analysis and dilatometric measurements. Temperature coefficients of resistivity for the various phases are included, as well as indicated phase-transformation temperatures and the heat of transition for the $\alpha \rightarrow \beta$ change. Values of the thermal conductivity are given for the temperature range 110 to 413°K. These values are used in conjunction with resistivity measurements to calculate Lorenz numbers as a check of the Wiedemann–Franz ratio. The room-temperature resistivity of plutonium exceeds that of bismuth by 22%, but is lower than the resistivity of α-manganese by approximately the same percentage. (auth)

13862

CARBONATE AND CARBONATE-OXALATE COMPLEX COMPOUNDS OF PLUTONIUM(IV). I. PLUTONIUM POTASSIUM CARBONATE. A. D. Gel'man and L. M. Zaitsev. Zhur. Neorg. Khim. 3, 1304-11(1958) June. (In Russian)

A method was developed for preparation of carbonate complex compounds of plutonium(IV). Four complexes of plutonium, $K_4[Pu(ClO_3)_4] \cdot nH_2O$, $K_6[Pu(CO_3)_5] \cdot (3$ to $4)H_2O$, $K_6[Pu(CO_3)_6] \cdot nH_2O$, and $K_{12}[Pu(CO_3)_8] \cdot nH_2O$, were prepared and investigated. It was found that the coördinated volume of the internal sphere of these complexes per CO_3^{2-} ion can equal eight. (R.V.J.)

Tritium and Tritium Compounds

13863

DETERMINATION OF THE ABSOLUTE ACTIVITY OF SOLID TRITIUM SAMPLES. Jan Rydberg (Research Inst. of National Defence, Sundbyberg, Sweden). Acta Chem. Scand. 12, 399-407(1958).

It is shown that the absolute specific beta activity of tritium in solid samples of finite thickness can be accurately determined with 2π internal gas-flow counters. The effects of self-absorption and back-scattering of tritium betas are discussed. (auth)

Uranium and Uranium Compounds

Refer also to abstracts 14403, 14407, 14427, and 14433.

13864 AECU-3787

Michigan. Univ., Ann Arbor.

POLAROGRAPHIC REDUCTION OF URANIUM(VI) UNDER COMPLEXING AND NONCOMPLEXING CONDITIONS — NATURE OF THE SULFATE COMPLEX. Report No. 34. Philip J. Elving and Alan F. Krivis. July 5, 1958. 19p. Project No. 8. Contract AT(11-1)-70. $3.30(ph OTS); $2.40(mf OTS).

The polarographic reduction of U(VI) to U(V) in acid solution is very sensitive to both type and concentration of anion present. Consequently, the reduction was studied using perchlorate as a noncomplexing anion and sulfate as a complexing anion. In $HClO_4$ solution, increasing the perchlorate concentration shifted $E_{1/2}$ to more positive potentials, which seem to correspond to junction potential effects. Increasing either $HClO_4$ or perchlorate concentrations increased the limiting current slightly, which can be attributed to a higher rate of disproportionation of U(V); other factors, e.g., viscosity of the solution, tend to counteract the effect of the disproportionation. In sulfate media, UO_2^+ is not strongly complexed, the association constant for the U(V)–sulfate complex being 0.15, if UO_2SO_4 is the most stable uranyl sulfate complex present. The effect of acid on the stability of the uranyl sulfate complex confirmed the existence of the complex as an uncharged species. Limiting currents were pseudo diffusion-controlled, e.g., increasing the solution viscosity by increasing the electrolyte content decreased the current; this is due to the maximum disproportionation rate of U(V) having been reached at even the lowest sulfuric acid level investigated; increasing the anion concentration consequently slowed down diffusion. (auth)

13865 GAT-230

Goodyear Atomic Corp., Portsmouth, Ohio.

KINETICS OF THE REACTION OF URANIUM HEXAFLUORIDE WITH SODIUM FLUORIDE POWDER, PELLETS, AND CRUSHED PELLETS. F. E. Massoth and W. E. Hensel, Jr. Apr. 24, 1958. 40p. Contract AT(33-2)-1. $1.25(OTS).

A basic study of the kinetics of the reaction between uranium hexafluoride and sodium fluoride powder, pellets, and crushed pellets is presented. The rate of the reaction, which has the complex, $UF_6 \cdot 3NaF$, as its end product, was determined by a weight-change method at constant pressure. The investigation was conducted under static conditions over the temperature range from 24 to 68°C. The reaction of uranium hexafluoride with sodium fluoride powder follows the parabolic rate law, while the reaction with crushed pellets follows the logarithmic rate law initially, and the parabolic law in later stages. The reaction with pellets obeys logarithmic kinetics to about 0.4 mole fraction converted, after which no apparent further reaction occurs. The reaction with the powder and crushed pellets proceeds to completion. Incomplete reaction with pellets is explained by a physical blocking effect. A brief discussion of gas-solid reactions is included. A physical model of the reaction mechanism is advanced; the five essential steps are: surface reaction, adsorption on the complex, build-up of the complex film, volume diffusion through the complex, and reaction at the interface. (auth)

13866 HW-48868(Rev.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

SLIP CASTING OF UO_2. D. R. Stenquist and R. J. Anicetti. July 10, 1958. 4p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The feasibility of slip casting UO_2 was investigated. This method consists of suspension of UO_2 particles in Plaster-of-Paris molds, and removal of the water through the mold surfaces leaving a casting of UO_2. This method has the advantage of low tooling costs and allowing for the production of a variety of shapes. Slip-casted UO_2 crucibles and rods were sintered to about 85% of the theoretical density. (J.R.D.)

13867 LA-472

[Los Alamos Scientific Lab., N. Mex.]

PREPARATION OF URANIUM METAL BY THE BOMB METHOD. R. D. Baker, B. R. Hayward, C. Hull, H. Raich, and A. R. Weiss. June 25, 1946. Decl. Dec. 2, 1957. 49p. Contract [W-7405-eng-36]. $7.80(ph OTS); $3.30(mf OTS).

A detailed description of methods of preparation of uranium by bomb reduction of UF_4 is presented. Developmental work for all scales of reduction is given, and it is pointed out that the larger-scale reduction techniques are in use for production of U^{235} metal. (auth)

13868 AEC-tr-3324

ADSORPTION OF URANIUM MICRO-AMOUNTS BY IRON HYDROXIDE AND ITS DESORPTION BY THE CARBONATE METHOD. I. E. Starik, F. E. Starik, and A. H. Apollonova. Translated by Oak Ridge National Lab. Library Staff from Zhur. Neorg. Khim. 3, 121-8 (1958). 16p.

It was found that the co-precipitation of micro-amounts of uranium with iron hydroxide takes place by the adsorption capture method. The dependence on the solution pH of the adsorption capacity of iron hydroxide has been established with respect to uranium in ammonium and carbonate media. Conditions for the co-precipitation of micro-amounts of uranium are established with methotitanic acid. The desorption conditions for micro-amounts of uranium ($n \cdot 10^{-5}$ to $n \cdot 10^{-6}$ g) from the surface of iron hydroxide colloids

(U: Fe = 1 : 10^5) using the carbonate method are established. Conditions for the complete separation of microamounts of uranium ($n \cdot 10^{-5}$ to $n \cdot 10^{-6}$ g) from solutions by its desorption by iron hydroxide are established. (auth)

13869

RADIATION OXIDATION OF QUADRIVALENT URANIUM SOLUTIONS. V. G. Firsov and B. V. Ershler. Atomnaya Energ. 4, 343-8(1958) Apr. (In Russian)

Equations describing the dependence of G (G = 2 to 4 kev/100 ev) on U^{4+} and expressions for the rate constants of H + OH, H + H, and U^{4+} + OH were derived. The yield of G is reduced with the increase of U^{4+} concentrations. This results from the reduction of U^{4+} by H radicals. Studies were made of the mechanisms of UO_2^{2+} inhibition of oxidation processes in U^{4+}. Equations for the rate constant of UO_2^{2+} + H, and H + H, and for reactions UO_2^{2+} + OH, H + OH, and H + H were calculated. An equation was derived describing the dependence of G on U^{4+} and UP_2^{2+}, which is in good agreement with the experimental data for a wide range of concentrations. (tr-auth)

13870

NEW COLORIMETRIC METHOD FOR THE DETERMINATION OF URANIUM WITH NEO-THORONE. Shozo Shibata and Teiichi Matsumae (Gov't. Industrial Research Inst., Nagoya, Japan). Bull. Chem. Soc. Japan 31, 377-8(1958) Apr.

Uranium, in microgram quantities, can be determined colorimetrically by the use of Neo-thorone (o-arsonophenyl-azo-chromothropic acid) in aqueous solution. The absorption spectra of the reagent and the uranium complex are given. The color develops in five minutes and its stability is adequate for the determination of uranium. (J.S.R.)

13871

THE SULFIDES OF URANIUM. Marius Picon and Jean Flahaut (Laboratoire de chimie des Hautes Températures, Paris). Bull. soc. chim. France No. 6, 772-80 (1958) June. (In French)

Six different compounds were characterized in the uranium–sulfur system: the polysulfide US_3, the normal sulfide US_2, which exists in three distinct crystalline forms, and the subsulfides U_3S_5, U_2S_3, and US. There also is an oxysulfide UOS. The formation conditions and their principal physical properties were studied, and some crystallographic determinations were made on all the isolated compounds. The high temperature chemical reactions were particularly considered. The valence state of uranium in all the compounds was discussed on the basis of magnetic and crystallographic data. It appears that in all the cases uranium is in the state of the U^{4+} ion, some metallic bonds appearing in all the subsulfides. (tr-auth)

13872

A STUDY OF PRECIPITATION OF HEXAVALENT URANIUM HYDROXIDE. S. A. Brusilovskii (Inst. of Geology, Petrography, Mineralogy, and Geochemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 120, 305-8(1958) May 11. (In Russian)

Conditions for the precipitation of hexavalent uranium hydroxide were studied, and the relation between the pH magnitudes at which the precipitation of the hydroxide begins and initial solubility and concentration of metal ions in the solution was determined. The curves of potentiometric titration of $UO_2(ClO_4)_2$ with sodium hydroxide were plotted. (R.V.J.)

13873

LUMINESCENCE SPECTRA OF COORDINATION URANYL NITRATE COMPOUNDS. G. I. Kobyshev and D. N. Suglobov (Zhdanov Leningrad State Univ.). Doklady Akad. Nauk S.S.S.R. 120, 330-2(1958) May 11. (In Russian)

The luminescence of water-free uranyl nitrate and some of its coördinated compounds with various additives was studied to find the effects of the coördination on the luminescence spectra. The luminescence spectra of microcrystalline powders of the following coördinated compounds were studied: $UN \cdot 2H_2O$, $UN \cdot 3H_2O$, $UN \cdot 6H_2O$, $UN \cdot nNH_3$, $UN \cdot 2C_5H_5N$, $UN \cdot 2(C_2H_5)_2O$, $UN \cdot 2(C_4H_9)_2O$, $UN \cdot 2(C_2H_4Cl)_2O$, $UN \cdot nC_2H_5OH$, $UN \cdot 2CH_3CN$, $UN \cdot 2C_6H_6NO_2$, $UN \cdot 2CH_3NO$, and $UN \cdot 2NO_2$ (where UN is $UO_2(NO_3)_2$). Also, the mixed compounds $UN \cdot 2H_2O \cdot 2(C_2H_5)O$ and $UN \cdot 2H_2O \cdot 2NO_2$ were investigated. (R.V.J.)

13874

THE CHEMICAL ENVIRONMENT OF PITCHBLENDE. Leo J. Miller (Ecstall Mining Co., Ltd., Toronto). Econ. Geol. 53, 521-45(1958) Aug.

Several uranium complex ions were found to be stable over a wide range of pH, temperature, and pressure. At 25°C and in neutral solutions uranyl complexes of carbonate, fluoride, and hydroxide remain in solution at concentration values between 10^{-5} M and 10^{-3} M. At elevated temperatures (215°C) the solubility of these ions at pH 7 is still above 10^{-5} M. At 25°C the above mentioned ions will react with a reducing agent (H_2S) at pH 7 to form pitchblende of small crystallite size. A similar reaction proceeds at elevated temperatures (215°C) and pH 7, but the pitchblende precipitates with larger crystallite dimensions. The uranous complex ions are relatively unstable. Solutions of uranous hydroxide precipitate a small amount of pitchblende at 25°C. At elevated temperatures (215°C) all of the uranium in solution converts to well crystallized pitchblende. (auth)

13875

SPECTROPHOTOMETRIC AND ELECTRICAL CONDUCTANCE STUDIES ON CHELATE FORMATION OF URANYL ION WITH AMMONIUM AURINTRICARBOXYLATE. Anil. K. Mukherji and Arun K. Dey (Univ. of Allahabad, India). J. Inorg. & Nuclear Chem. 6, 314-18 (1958) July.

The formation of a colored chelate between uranyl ion and ammonium aurintricarboxylate with λ_{max} at 540 mμ, has been reported. The chelate has a composition of 1:1. The formation constant at 25°C is $5.9 \pm 0.5 \times 10^4$, and the free energy of formation -6.51 ± 0.05 kcal at the same temperature. (auth)

13876

SOME OBSERVATIONS ON THE IDENTIFICATION OF COMPOUNDS IN THE SYSTEM URANIUM–ALUMINUM. R. F. Hills (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inst. Metals 86, 438-41(1958) June.

The identification of three compounds encountered in uranium–aluminum alloys containing over 22 wt. % aluminum has been studied. Three etching reagents were used: an electrolytic chromic acid/acetic acid bath, a 1% hydrofluoric acid solution, and a 50% nitric acid solution. Where two distinct compounds coexist in the sample, identification is easily achieved. Some difficulty is encountered with alloys in the (Al + UAl_4) phase field, where rapid cooling may suppress the formation of UAl_4 so that metastable UAl_3 is retained. In this case

the use of polarized light can be helpful when the compound is present in fairly massive form. The etching characteristics of the various compounds are tabulated. (auth)

13877

A KINETIC STUDY OF THE DISSOLUTION OF UO_2 IN CARBONATE SOLUTION. Ray L. Pearson and Milton E. Wadsworth (Univ. of Utah, Salt Lake City). Trans. Met. Soc. AIME 212, 294-300(1958) June.

Sintered UO_2 samples were leached in carbonate solutions of various concentrations. A pressurized system was used so that it was possible to investigate the kinetics of the reaction to 200°C with oxygen overpressures as high as 800 psi. The surface active species in solution appears to be the undissociated acid H_2CO_3. Competitive adsorption between oxygen and H_2CO_3 occurs at the UO_2 surface resulting in an over-all rate decrease at high concentrations of H_2CO_3. Oxygen splits between two surface active sites and the slow step of the surface reactions involves a rearrangement or diffusion of oxygen on the mineral surface. (auth)

13878

STUDIES IN THE CHEMISTRY OF URANIUM- AND THORIUM-OXALATES. A. A. Grinberg, G. I. Petrzhak, and L. I. Evteev. Zhur. Neorg. Khim. 3, 204-11(1958). (In Russian)

On the basis of physical-chemical studies, the coördinate structure of the compound $K_4[U(C_2O_4)_4] \cdot 5H_2O$ was determined. Its behavior in water solution was studied. A comparative investigation was made of the physical and chemical properties of the hexahydrate of thorium and uranium oxalates. The conductivity, pH, and solubility were studied. It was shown that the uranium oxalate has more strongly acidic properties than the thorium oxalate. (J.S.R.)

13879

EXTRACTION OF PERCHLORIC ACID AND URANYL PERCHLORATE WITH TRIBUTYL PHOSPHATE. V. B. Shevchenko, I. V. Shilin, and A. S. Solovkin. Zhur. Neorg. Khim. 3, 225-30(1958). (In Russian)

The distribution of perchloric acid between its aqueous solution and TBP in the solvent extraction of uranyl perchlorate was studied. It was shown that the transition of the uranyl perchlorate and the perchloric acid to TBP is determined by the ionic strength of the water phase, the TBP concentration in the organic phase, the nature of the diluent, and the salting-out properties of the alkali metal ion. It was found that the graphic method of determination of the composition of the complex compounds extracted by the TBP was inapplicable in the case of uranyl perchlorate and perchloric acid. (J.S.R.)

13880

STUDIES OF JOINT SOLUBILITY OF URANYL NITRATE AND NITRATES OF ALKALI EARTH METALS IN WATER. M. A. Yakimov, N. F. Nosova, and V. A. Grishin. Zhur. Neorg. Khim. 3, 504-7(1958) Feb. (In Russian)

Isothermic solubility was studied in ternary systems $UO_2(NO_3)_2-Ba(NO_3)_2-H_2O$ at 0, 25, and 50°. The eutectoid point for this system was not found. Three solubility curves corresponding to the solubility of tetrahydrate of strontium nitrate, anhydrous strontium nitrate, and hexahydrate of uranyl nitrate (transition points at 37.33% $UO_2(NO_3)_2$, 13.18% $Sr(NO_3)_2$, and 51.39% $UO_2(NO_3)_2$, 4.78% $Sr(NO_3)_2$ were found for $UO_2(NO_3)_2-Sr(NO_3)_2-H_2O$ at 25°. For $UO_2(NO_3)_2-Ca(NO_3)_2-H_2O$ at 0 and 25°, the eutectoid points are at 6.75% $UO_2(NO_3)_2$, 43.32% $Ca(NO_3)_2$, and 7.92% $UO_2(NO_3)_2$, 50.48% $Ca(NO_3)_2$, respectively. In the investigated systems, binary salts were not observed. (R.V.J.)

13881

INVESTIGATIONS OF URANYL NITRATE–WATER–DIBUTYL ETHER. ISOTHERM OF SOLUBILITY AT 25°. V. M. Vdovenko and I. G. Suglobova. Zhur. Neorg. Khim. 3, 1403-9(1958) June. (In Russian)

The isotherm of uranyl nitrate–water–dibutyl ether solubility at 25°C was studied, and the positive effect of coördinated water molecules on the solubility is indicated in relation to the low solubility of the water-free uranyl nitrates in ethers. (R.V.J.)

Waste Disposal

Refer also to abstract 14413.

13882 AECU-3791

Griscom-Russell Co., Massillon, Ohio.

FINAL REPORT ON E. I. DU PONT de NEMOURS RADIOACTIVE WASTE CONCENTRATION PROJECT. Job 10522. Theodore C. Carnavos. Oct. 15, 1956. 55p. (RT-19-56). $9.30(ph OTS); $3.60(mf OTS).

An evaporator system was developed and tested which will concentrate two types of non-radioactive wastes. The wastes were of the slurry type with an initial concentration of 32% solids and a final concentration of 70% solids by weight. Information concerning design practices for this type of evaporator, startup and operating procedures, methods of recovery from unexpected shutdown, and procedures for descaling was gained. The test waste was synthetic and not radioactive; however, the procedures were evolved for application to radioactive materials. In addition, over-all heat transfer rates as a function of temperature difference and the relationship between percent concentration and boiling point for the two wastes were obtained. (J.R.D.)

ENGINEERING

Refer also to abstracts 14423 and 14424.

13883 APEX-390

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

HYDRODYNAMIC AND HYDROSTATIC LUBRICATED BEARINGS WITH PARTICULAR REFERENCE TO AIR BEARINGS: A LITERATURE SURVEY. M. A. Koenders. Apr. 1958. 32p. Contracts AF33(038)-21102 and AT(11-1)-171. $1.00(OTS).

A search of the unclassified literature and General Electric reports has been made with reference to the use of air as the lubricating fluid in hydrostatic and hydrodynamic bearing applications. (auth)

Heat Transfer and Fluid Flow

13884 AD-135308

Coating and Chemical Lab., Aberdeen Proving Ground, Md.

SURVEY OF HEAT TRANSFER LITERATURE. M. Levy. June 6, 1957. 56p. Project No. 593-28-001. (CCL-24).

The field of heat transfer is surveyed and a bibli-

ography prepared of the recent available publications in books and technical journals. An extensive heat transfer literature search was conducted on four basic principles which may offer a means of effecting satisfactory cooling under anticipated conditions of new vehicular engines that will be much smaller and lighter and have greater power output than present engines. The four basic principles are surface phenomena, thermodynamics of chemical changes, thermodynamics of change of state, and thermodynamics of electromagnetic changes. The survey covers the period 1942-1956. (auth)

13885 AERE-E/R-1267

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FREE CONVECTION IN HEAT GENERATING FLUID (LAMINAR FLOW). J. Woodrow. Oct. 1953. 21p.

An investigation is carried out into two cases of laminar convective flow in a heat generating fluid. The velocity and temperature distributions are obtained for the two-dimensional and cylindrical cases, and the stability of the laminar regime is discussed. The flow depends on two non-dimensional groups $\rho c Ag \epsilon D^4/k\nu$ and $Hg\epsilon D^3/k\nu^2$. The form of the velocity and temperature curves depends only on the first of these groups. The stability of the flow is controlled by both. The critical value of the second group is some function of the first. (auth)

13886 APEX-391

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

HEAT TRANSFER IN TURBULENT FLOW THROUGH NONCONCENTRIC ANNULI HAVING UNEQUAL HEAT RELEASE FROM THE WALLS. J. F. Heyda. June 1957. 29p. Contracts AF33(038)-21102 and AT(11-1)-171. $1.00(OTS).

An analytical procedure is presented for determining the temperature field in a nonconcentric annulus when the heat released from the bounding, circular, cylindrical walls is of unequal strength. In this analysis it is assumed that the line of maximum velocities for the turbulent flow of an incompressible fluid through a nonconcentric annular cross section is equivalent to that for laminar flow, since the latter can be obtained exactly in the notation of a bipolar coordinate system. In the integration of the defining heat transfer equations, a continuous velocity distribution for turbulent flow near a smooth wall, derived by Van Driest, is used. (auth)

13887 CF-58-8-6

Oak Ridge National Lab., Tenn.

A FLOW VISUALIZATION LOOP FOR FLOW PATTERN STUDIES IN REACTOR MODELS. W. R. Mixon and H. A. MacColl. Aug. 4, 1958. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The installation of a milling yellow flow visualization loop has been completed. Milling yellow is an organic dye which when dissolved in water exhibits flow double refracting properties that permit visual observations of flow patterns. The equipment is to be used in qualitative studies of flow patterns in various models of reactor vessels and components. (auth)

13888 GMR-103

General Motors Corp. Research Staff., Detroit.

REACTOR MATERIAL BURNOUT PROGRAM. J. M. Bookston. Nov. 20, 1957. 94p.

The operation of a nuclear reactor over a period of time results in altering the concentrations of the various fissile and fertile nuclides and of poisons, thus modifying the operating characteristics of the reactor. A computer code to determine this time dependence by performing the necessary calculations on the IBM 704 is described. (auth)

13889 TID-3305(Suppl. 1)

Technical Information Service Extension, AEC.

HEAT TRANSFER AND FLUID FLOW: A BIBLIOGRAPHY OF SELECTED REPORT LITERATURE. James M. Jacobs, comp. June 1958. 435p. $6.00 (OTS).

A total of 2519 annotated references to the unclassified report literature is presented. Subjects covered under heat transfer and fluid flow include radioinduced heating, boiling, boilers, evaporators, pumps, heat exchangers, hydrodynamics, coolants and their properties, thermal and flow instrumentation, high-temperature materials, thermal properties of materials, and thermal insulation. Subjects covered less completely include thermodynamics, aerodynamics, high-temperature corrosion, corrosion specific to heat transfer systems, erosion, mass transfer, corrosion film formation and effects, coolant processing and radioactivity, radiation effects of heat transfer materials, and pertinent data of thermonuclear processes. Subject, report number, and author indexes are given. (auth)

13890 WADC-TN-58-207

Aerojet-General Corp., Azusa, Calif.

EXPERIMENTAL STUDIES ON HEAT TRANSFER AND FLUID FLOW. Quarterly Progress Report No. 2 [for] April 1 to June 30, 1958. E. L. Geery, L. Green, Jr., and K. L. Nall. Aug. 1958. Project No. 3151. Contract AF33(616)-5552. (AGC-0140-05-2(Vol. II)).

The two-dimensional-nozzle flow experiments indicated that the porous-wall injection technique may be successfully applied for control of wall temperature and for promotion of flow separation. Water-checkout tests of the instrumentation for the study of heat transfer to a flow of fluid in the critical region was initiated. Spark photographs were made of the flow. (For preceding period see WADC-TN-58-123.) (auth)

13891

HEAT TRANSFER TO WATER IN TURBULENT FLOW IN INTERNALLY HEATED ANNULI. Ralph P. Stein and William Begell (Columbia Univ., New York). A.I.Ch.E. Journal 4, 127-31(1958) June.

Nearly 900 values of local heat transfer coefficients were correlated for water flowing through long annuli $\frac{1}{8}$, $\frac{1}{4}$, and $\frac{3}{8}$ in. wide, electrically heated at their inner surfaces and containing three spacer ribs. Both cosine and uniform lengthwise heat-flux distributions were employed. All heat transfer coefficients were computed for positions corresponding to (L/D_e) ratios larger than 150. Several methods of correlation were attempted and compared, especially with respect to the method of evaluating physical properties. The proportionality of the Colburn j factor to the Prandtl and Reynolds numbers with their usual exponents was verified, and the dependence of j upon D_2/D_1 was analyzed. There was no significant effect of cosine heat-flux distribution on the heat transfer coefficients. Evaluating physical properties at the usual film temperature gave the best correlation. A simplified dimensional equation for water at moderate temperatures and pressures was also developed. (auth)

13892

VELOCITY PROFILE FOR FULLY DEVELOPED TURBULENT FLOW IN A PIPE. Thomas J. Hanratty

and Duane L. Flint (Univ. of Illinois, Urbana). A.I.Ch.E. Journal 4, 132-6(1958) June.

An equivalent Poiseuille's Law is derived for a homogeneous isotropic turbulent field. The derivation is based on an analogy between momentum transfer and heat and mass transfer, three coefficients being used to characterize the exchange process: the molecular viscosity μ, an intensity parameter to characterize the magnitude of the turbulent velocity fluctuations $\overline{v^2}$, and a scale parameter to characterize the scale of the turbulence τ. (auth)

13893

MIXING OF FLUIDS FLOWING THROUGH BEDS OF PACKED SOLIDS. Earl A. Ebach and Robert R. White (Univ. of Michigan, Ann Arbor). A.I.Ch.E. Journal 4, 161-9(1958) June.

An extension of the known data and the results of an investigation of the axial mixing of liquids flowing through fixed beds of solids are presented. The variables which were investigated were fluid velocity, particle diameter, particle shape, and liquid viscosity. (J.R.D.)

13894

HEAT TRANSFER IN FILM CONDENSATION. Eric Baer and James M. McKelvey (Johns Hopkins Univ., Baltimore). A.I.Ch.E. Journal 4, 218-22(1958) June.

A theoretical analysis of heat transfer in film condensation is presented in which the total vapor-side resistance to heat transfer is obtained by adding the resistance to conduction through the condensate film to the resistance due to the condensation process at the vapor-liquid interface. Under ordinary conditions conduction in the condensate film is controlling if the condensation coefficient is greater than 0.10; however, if the total pressure is low, under conditions of low heat flux or low condensation coefficient, the resistance of both processes must be considered. (J.R.D.)

13895

CRITICAL HEAT FLUX FOR THE LONGITUDINAL FLOW OF WATER OVER TUBES. B. A. Zenkevich, V. I. Subbotin, and M. F. Troyanov. Atomnaya Energ. 4, 370-2(1958) Apr. (In Russian)

Descriptions are given of a contact column with tube bundles designed for the investigation of critical boiling in longitudinal flow. (R.V.J.)

13896

CALCULATION OF COOLING TOWERS AND INJECTION COOLERS BY MEANS OF AN EVAPORATION METHOD. K. Spangemacher. Brennstoff-Wärme Kraft 10, 209-15(1958) May. (In German)

Calculation and evaluation of cooling towers, as recommended by Merkel, are critically examined. The usual methods of practical calculation are explained as well as a new procedure which combines great accuracy with brevity. Merkel's method is extended to injection coolers for gas and compressed air. It was discussed whether the dimensionless "evaporation coefficient" should be called the "Merkel coefficient." (tr-auth)

13897

NEW APPROACH FOR EVALUATING EXPERIMENTS OF NATURAL WATER CIRCULATION IN STEAM BOILERS. Arthur Zinzen and Franz Schubert. Brennstoff-Wärme-Kraft 10, 216-18(1958) May. (In German)

Observations show that gas bubbles rising in water carry along a considerable quantity of water. A new equation for the evaluation of tests on water circulation is given with regard to this effect. It is possible now to compare qualitatively results by different authors and to explain anomalies arising. (tr-auth)

13898

ELEVATING THE HEAT TRANSFER COEFFICIENT OF SURFACE CONDENSERS BY DEAERATION OF COOLING WATER. L. Schwarz. Brennstoff-Wärme-Kraft 10, 224(1958) May. (In German)

It was shown the temperature difference between the cooling water outlet and the condenser can be lessened by the addition of a ventilator. The temperature difference could be lessened further by the degassing of the cooling water in a vacuum chamber before its entry into the condenser. (J.S.R.)

13899

SPECIFIC HEAT PERFORMANCE OF HEAT EXCHANGERS FOR HOT STEAM, ESPECIALLY FOR FEEDWATER HEATERS. Siegfried Kriese. Brennstoff-Wärme-Kraft 10, 323-5(1958) July. (In German)

Formulas were derived for the specific heat capacity and the logarithmic temperature difference of heat exchangers in which the materials taking part in the heat transfer change their phase. They defined the processes accurately and allowed a simple evaluation of the research results. The special advantage of these formulas is that they can be applied without limitations and with equal accuracy to all feedwater heaters without regard for temperature. (tr-auth)

13900

APPLICATION TO FORCED DRAUGHT COOLING TOWERS OF RESEARCH RESULTS ON TRANSFER OF HEAT AND MATTER. K. Spangemacher. Brennstoff-Wärme-Kraft 10, 325-30(1958) July. (In German)

Some new results on heat and matter transfer to drops and water surfaces were compared with each other. It was shown that they led to almost equal results when the diameter of the drops or the distance to the edge of the water surfaces were inserted as the characteristic length L. A comparison of the theoretical and experimental results on cooling towers show agreement. It is uncertain from these results whether the Soviet experiments, which show that an increase of the relative humidity decreases the heat and matter transfer, can be applied to cooling towers. (tr-auth)

13901

DEVELOPMENT OF THE CALORIMETER HEAT TRANSFER GAUGE FOR USE IN SHOCK TUBES. Peter H. Rose (Avco Research Lab., Everett, Mass.). Rev. Sci. Instr. 29, 557-64(1958) July.

A heat transfer gage suitable for measuring extremely high heat transfer rates under the quasi-transient conditions occurring in shock tubes has been developed. The instrument is based on a calorimetric principle and is made possible by the short steady state times inherent in shock tubes. The technique developed extends, verifies, and supplements the shock tube heat transfer measurements made by thin film resistance thermometers. The operating principles and experimental experiences with calorimeter heat transfer gages are reported in some detail. Much heat transfer data obtained with calorimeter gages have been collected and published. Experimental measurements of laminar and turbulent heat transfer rates at velocities up to satellite speeds, approximately 26,000 ft/sec, have been reported. Heat transfer rates as high as 40 kw/cm^2 have been encountered in these experiments. (auth)

Materials Testing

13902 DP-252
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
AN EDDY CURRENT THICKNESS TESTER FOR COPPER PLATED ON URANIUM. Arthur P. Holt, Jr. and Louis H. Cook, Jr. Nov. 1957. 12p. Contract AT(07-2)-1. $0.50(OTS).

An instrument is described which measures the thickness of copper plating on a uranium base. The instrument makes use of the eddy current principle and is usable in the range of 0.004 to 0.012 in. with an accuracy of 5%. With minor modifications and adjustments the instrument may also be used to measure thicknesses as great as 0.035 in., of either copper or aluminum, on any substrate whose specific resistivity approximates that of uranium. (auth)

13903 NP-6798
National Advisory Committee for Aeronautics and Syracuse Univ., N. Y. Research Inst.
LITERATURE SURVEY ON THE EFFECT OF CYCLIC HEATING AND LOADING ON THE CREEP, STRESS-RUPTURE AND FATIGUE PROPERTIES OF METALS AT ELEVATED TEMPERATURES. S. S. Manson, G. Sachs, and W. F. Brown, Jr. June 1957. 119p.

The basic mechanisms observed to be effective when cyclic loading and heating are involved are briefly outlined. The experimental data existing in the literature on specific materials subjected to cyclic heating are described in detail. Descriptions and derivations are given of analytical methods that have appeared in the literature for predicting the experimental results in advance of test and for generalizing the results to extend the range of the experimental variables. 50 references. (J.R.D.)

13904 NYO-4614
Harvary Univ., Boston. Air Cleaning Lab.
EVALUATION OF THE ELECTRO-PL AND ELECTRO-KLEAN DUST COLLECTORS. Richard Dennis, Edward Kristal, and Leslie Silverman. July 21, 1958. 50p. Contract AT(30-1)-841. $7.80(ph OTS); $3.30(mf OTS).

Results are presented from performance tests on the Electro-PL and Electro-Klean air cleaning devices. Both devices were tested for moderate cleaning of low loadings such as those encountered in the atmospheric dust range. (C.H.)

13905 WAL-TR-715/2
Watertown Arsenal Lab., Mass.
BUCKLING CHARACTERISTICS OF CIRCUMFERENTIALLY REINFORCED THIN CYLINDRICAL SHELLS SUBJECTED TO AXIAL COMPRESSION AND INTERNAL PRESSURE. Jerome J. Connor, Jr. Aug. 1958. 30p. Project Title: ABMA—STRESS ANALYSIS STUDIES FOR THE "JUPITER" PROJECT.

An experimental study employing aluminum models was conducted to evaluate the possible modification in buckling characteristics resulting from the addition of integral circumferential stiffeners. This initial phase was limited to a particular ribbed configuration suggested by ABMA and the models were subjected to internal pressure as well as axial compression. Emphasis was placed on whether the location of the ribbing (internal or external) influenced the strength appreciably and also on how the critical stress for the milled cylinders compared with that of the unmilled cylinders having the same nominal thickness. (auth)

13906
EXPERIMENTS IN THE TESTING OF INGOTS WITH GAMMA RADIATION AND VERY HARD X RADIATION. Otto Nickel (Laboratorium der Vacuumschmelze AG, Hanau, Germany). Z. Metallk. 49, 368-75(1958) July. (In German)

Non-destructive testing by Co^{60} is applied to small ingots having 80 mm diameter. A 15 Mev-betatron can be used with diameters of 300 mm. The technique of testing is described. (auth)

13907
SYMPOSIUM ON RADIOISOTOPES. PRESENTED AT THE SECOND PACIFIC AREA NATIONAL MEETING, LOS ANGELES, CALIF., SEPTEMBER 21, 1956. ASTM Special Technical Publication No. 215. Philadelphia, American Society for Testing Materials, 1958. 96p. $2.75.

Papers, presented on testing techniques utilizing radioisotopes, demonstrated the wide range of industrial uses to which they are applicable. The articles were "Electroplating and Metal Preservation Studies Utilizing Radioisotopes," "Evaluation of Rubber Deterioration by Means of Phosphorus-32," "Autoradiography as a Testing Technique," "Use of Radioactive Tracers in the Study of Soil Removal and Detergency," "Refinery Scale Application of Radioactive Tracers," "Activation Analysis for Industry," "Thickness, Density, and Concentration Gaging with Radioisotopes," "Will ASTM Standards Be Influenced by Radiation Effects in Metals?," and "The Problem of Establishing Specification for Irradiated Organic Materials." (J.S.R.)

Pumps

Refer also to abstract 14422.

13908 CF-54-8-234
Oak Ridge School of Reactor Technology, Tenn.
SUMMARY OF HIGH TEMPERATURE LIQUID METAL, FUSED SALT PUMP DEVELOPMENT WORK IN THE ORNL-ANP PROJECT FOR THE PERIOD JULY 1950–JANUARY 1954. Edsel S. Farris, comp. Aug. 1954. Decl. Nov. 15, 1957. 98p. $15.30(ph OTS); $5.40(mf OTS).

All of the information available on high-temperature pumps originally reported in the ANP quarterly reports is summarized. The development program was more of a seal development than a specific pump program. Frozen seals of various kinds were tried and for many commercial applications would be perfectly satisfactory. For application in a system such as the ARE, operation of the frozen seal pump is questionable. A gas-sealed pump was developed and is expected to be entirely adequate for a system like the ARE. (W.L.H.)

Waste Disposal

Refer also to abstract 14645.

13909 CRCE-736
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
METHODS OF STORAGE OF SOLIDS CONTAINING FISSION PRODUCTS. L. C. Watson, H. K. Rae, R. W. Durham, E. J. Evans, and D. H. Charlesworth. June 1958. 60p. (AECL-649). $1.50(AECL).

The requirements of a site for the permanent storage

of fission products contained in glass are discussed. The most important considerations are the release of fission products from the glass and the removal of the heat generated by fission product decay. If water is allowed to remain in contact for extended periods with the glass produced from the large-scale processing of irradiated fuels, the quantity of fission products released is significant, even though the glass is very resistant to attack. On the basis of present knowledge, storage in concrete vaults or in vaults constructed in solid rock is the only way in which water exclusion can be reasonably guaranteed over periods of the order of hundreds of years. In this case the resistance of the glass to attack by water then provides a second line of defense should the vault fail in the future. It is possible that the glass might be buried directly in dry ground where release of fission products would also be restricted. Additional knowledge of the rate of release of fission products to ground water by leaching from the glass, and of the fate of the fission products freed in this manner, may show that burial directly in wet ground in selected areas could be acceptable. Other methods, including burial in permafrost areas, disposal in the ocean, storage in natural caverns and storage in drilled holes were considered, but could not be recommended at present. Crude estimates indicate that the glass can be stored in vaults or in the ground at a cost which meets the requirements of economical nuclear power. (auth)

13910 TID-3311
Technical Information Service Extension, AEC.
RADIOACTIVE WASTE PROCESSING AND DISPOSAL: A BIBLIOGRAPHY OF SELECTED REPORT LITERATURE. Hugh E. Voress, Theodore F. Davis, and Thomas N. Hubbard, Jr. June 1958. 131p. $2.75 (OTS).

An annotated bibliography is presented containing 698 references to unclassified reports on current and proposed radioactive waste processing and disposal practices for solutions from radiochemical processing plants and laboratories, decontamination of surfaces, air cleaning, and other related subjects. Author, corporate author, subject, and report number indexes are included. (auth)

13911
PURIFYING RADIOACTIVE SEWAGE OF NUCLEAR POWER STATIONS. P. Profos. Brennstoff-Wärme-Kraft 10, 228-9(1958) May. (In German)

In the purification of radioactive wastes from nuclear power stations there are two general approaches, the circulatory system and the through-put system. In the circulatory system, a purification stage is inserted into a cycle to keep the radioactivity of the cycle as low as possible. In the through-put system, the problem is to dilute the waste so that it can be discharged into the drainage system. The problems and methods of both are discussed. (J.S.R.)

MINERALOGY, METALLURGY, AND CERAMICS

Ceramics and Refractories

Refer also to abstracts 14425 and 14438.

13912 NP-6867
Honeywell Research Center, Hopkins, Minn.
A PRELIMINARY EVALUATION OF THE SILVER CHLORIDE–ALUMINA SYSTEM AS A MEANS OF STUDYING FINE PARTICLE STRENGTHENING OF SOLIDS. Second Technical Report. T. L. Johnston, R. J. Stokes, and C. H. Li. July 1958. 33p. Project No. NR-039-041. Contract Nonr-2456(00).

In metals and alloys hardened by the addition of a dispersed phase (e.g., cermets, S.A.P.-type materials) it is difficult experimentally to study the relationship between microstructural parameters and resistance to deformation, fracture, and recovery. To overcome this difficulty, the silver chloride–alumina system was adopted. Silver chloride has the unique advantage of being ductile and transparent. Furthermore, dislocations can be readily decorated at room temperature. It was shown that the chemical stability, bond strength, and wettability of the two phases are such that this system has great potential as a medium for studying the principles of fine particle strengthening of solids. Preliminary results show that (a) particle shape has an important bearing on the deformability of cermet-type compacts and (b) the high temperature mechanical stability in S.A.P.-type materials is probably due to limitations imposed upon the climb and annihilation of dislocations in the neighborhood of hard particles and not due to the resistance to migration of grain boundaries. (auth)

13913
ELECTRICAL SPARKOVER OF TITANIUM CONTAINING CERAMIC MATERIAL WITH DIELECTRIC PENETRABILITY OF 80. I. E. Balygin. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 427-32(1958) Apr. (In Russian)

Experiments were made with specimens of titanium ceramic material with ~2% Al_2O_3, ~3% SiO_2, ~89% TiO_2, and 3.9% ZrO_2. The oscillogram data for electrical breakthrough are tabulated, and microstructures of the material sintered at 1350, 1400, and 1460°C are shown. (R.V.J.)

Corrosion

Refer also to abstracts 14434 and 14437.

13914 NP-6890
Horizons, Inc., Cleveland.
RESEARCH FOR COATINGS FOR PROTECTION OF NIOBIUM AGAINST OXIDATION AT ELEVATED TEMPERATURES. Quarterly Report No. 2 [for] October 1, 1957–December 31, 1957. E. C. Hirakis. Feb. 24, 1958. 53p. Contract AF33[616]-5356.

A number of niobium-base alloys were prepared by inert-arc melting. Specimens were fashioned from these small ingots by grinding or machining, depending upon hardness, and oxidation tested by a continuous weighing method. The bulk of the tests were conducted at 2000°F in slowly flowing air. Average weight gains in terms of milligrams per square centimeter per hour were determined and the oxidation-reaction rate constants were calculated for each alloy at the temperature concerned. Since no niobium-base alloys have been developed capable of withstanding exposure to air at 2500°F and higher for use as protective coatings on niobium, other materials and methods for this application are being investigated. (auth)

13915 NP-6891
Horizons, Inc., Cleveland.
RESEARCH FOR COATINGS FOR PROTECTION OF NIOBIUM AGAINST OXIDATION AT ELEVATED TEMPERATURES. Quarterly Report No. 3 [for] January 1, 1958 to March 31, 1958. E. C. Hirakis. Apr. 15, 1958. 36p. Contract AF33(616)-5356.

The investigation has been concerned with the utiliza-

tion of flame-spraying of metal powders and electrodeposition as techniques for the application of oxidation-resistant coatings to niobium for use at temperatures above 2500°F in air. Conventional powder spraying techniques were employed in the deposition of a number of alloy powders. Oxidation tests conducted on several coated specimens at 2500°F indicated that although certain of the alloys show promise insofar as oxidation resistance is concerned, much remains to be accomplished in the development of a consistent procedure for the application of the coatings to niobium. The factors affecting the quality of flame-deposited alloy coatings as produced were evaluated on the basis of a few tests. The work is being continued along the same lines. (For preceding period see NP-6890.) (auth)

13916 NYO-7931

Aeroprojects, Inc., West Chester, Penna.

APPLICATIONS OF ULTRASONIC ENERGY. Progress Report No. 10. Covering Period from June 1, 1958 to July 31, 1958. Aug. 1958. 26p. Contract AT(30-1)-1836. $4.80(ph OTS); $2.70(mf OTS).

Further investigation of mercury disintegration of fuel-element cladding materials under ultrasonic influence revealed a measurable rate of ultrasonic attack for Zircaloy-2, corresponding with previously obtained results with Type 304 stainless steel. Ultrasonic attack rates on thorium in mercury at 72° to 88°C ranged to 6.92 mg/cm^2/hr under the experimental conditions used. Ultrasonic application produced a positive and significant effect on the flow of thixotropic thorium amalgam through an orifice, the rate of flow being markedly increased with modest increase in ultrasonic power. From experimentation to date, it appears that ultrasonic agglomeration supplemented by the use of additive liquid aerosol particles can achieve sufficient decontamination in calciner off-gas to materially reduce the health hazard. Using a solid KCl simulant aerosol, a reference was established for evaluating improvements in operating techniques, and test data indicate that collection efficiency improves with large volumes of additive aerosol, low flow rates, and a relatively low ultrasonic frequency. Studies of ultrasonic coalescence in stabilized kerosene/water emulsions, using apparatus permitting the development of annular standing waves, indicated effective emulsion breaking on a continuous basis at flow rates in the range of 144 to 360 cc/min. The annular geometry apparently leads to superior results through minimization of circulation effects. (auth)

13917 S and T Memo-17/57

Gt. Brit. Admiralty Central Metallurgical Lab.

CAVITATION EROSION—A REVIEW OF PRESENT KNOWLEDGE (JUNE 1957). D. J. Godfrey. Sept. 1957. 16p.

Cavitation erosion is a type of damage, characterized by pitting attack, which may occur in hydraulic systems having extreme conditions of turbulence or high-speed liquid flow. It has been explained for many years as physical damage consequent upon "hammer blows" or shock waves following collapse of vacuum or vapor-filled cavities which may form within liquids when local regions of low pressure arise. High pressures have been shown mathematically to occur, but little success has been found with practical measurements of these, due to the extremely transient nature of the pulses. Modifications have been made to the original mathematical calculation of the forces involved, and these are dealt with briefly. Of late it has appeared probable that forces other than of a purely hydromechanical nature may be involved. Thus, the part played by corrosion has been found to be important, especially at low cavitation intensities and cathodic protection has been used with success to reduce cavitation erosion. The effects of entrained and dissolved air in cavitation erosion are discussed, and the dissimilarities and resemblances between impingement attack and cavitation erosion are reviewed. The properties of materials which affect resistance to cavitation erosion, particularly surface hardness and corrosion fatigue resistance, are considered and materials resistant to cavitation erosion are listed. Methods are given for ameliorating cavitation damage. Reference to some 50 articles is made. (auth)

13918 AEC-tr-3319

ELECTROLYTIC OXIDATION AND GALVANIC DEPOSITS ON TITANIUM. (L'oxydation Electrolytique et les Dépôts Galvaniques sur Titane). H. Richaud. Translated by Oak Ridge National Lab. Library Staff from Rev. mét. 54, 787-92(1957). 15p.

Various electrolysis factors which can affect the anodic and cathodic treatment of titanium were studied. Experimental results make it possible to prove a relationship between the electrolytic surface treatments of titanium and aluminum. It was found possible to anodically form oxide layers on titanium which increase with time, the increase being more rapid as the current density increases. With respect to the galvanic coatings, the existence of a natural oxide film on titanium necessitates, before the electrolytic deposit, a preparation of a susceptible surface to allow adhesion of the galvanic deposits. The placing of the preparation at the anode and the cathode in an organic chloride solution gives good results. (J.E.D.)

13919

STUDIES ON THE RESISTANCE TO CORROSION OF SOLID METALLIC SOLUTIONS. THE SYSTEM In—Pb. N. N. Gratsianskii and N. A. Bogacheva (Inst. of General and Inorganic Chemistry, Kiev). Zhur. Fiz. Khim. 32, 875-81(1958) Apr. (In German)

Corrosion of solid solutions of In—Pb was studied in 3% NaCl, 5% HCl, and 1% H_2SO_4 solutions at 20°C and in 1% citric acid solution at 16, 20, 30, and 50°C. In all the experiments except the 3% NaCl solution corrosion resistant boundaries were found to appear at different constituent ratios of the alloy from 50 to 80 at.% Pb. The resistance to corrosion was determined by a gravimetric method. Concurrently measurements were made of the potentials of the corroding alloys. In all the corrosive solutions the corrosion resistant boundaries were revealed due to the formation of a corrosion resistant surface layer of varying thickness (up to 3μ). In 1% H_2SO_4 solution this layer consists of lead atoms whereas in 5% HCl it consists of a solid solution of In—Pb of the ratio 2 to 3. (tr-auth)

13920

THE CORROSION OF STAINLESS AND CARBON STEELS DURING CATHODIC POLARIZATION IN NITRIC ACID SOLUTIONS. N. D. Tomashev, M. M. Kurtepov, and E. N. Mirolyubov (Inst. of Physical Chemistry, Moscow). Zhur. Fiz. Khim. 32, 904-8 (1958) Apr. (In Russian)

Corrosion of stainless steel, niobium steel, and carbon steel in nitric acid solutions of 3 to 40% was studied. (R.V.J.)

Geology and Mineralogy

13921 RME-2036(Rev.)

Salt Lake Area Office, AEC.

PRELIMINARY REPORT ON A URANIUM OCCURRENCE

AND REGIONAL GEOLOGY IN THE CHERRY CREEK AREA, GILA COUNTY, ARIZONA. Byron J. Sharp. July 1956. 17p. $0.20(OTS).

The Black Brush uranium claims in the Cherry Creek area, Gila Co., Ariz., are approximately 36 miles north of Globe, Ariz. The area is underlain by essentially flat-lying sedimentary rocks of the Precambrian Apache group which have been block faulted and intruded by diabase of possible Tertiary age. Uranium occurs in the upper member of the Dripping Spring quartzite and is associated with sets of fractures which trend N. 20° E. and N. 70° W. A radiometric traverse of the Black Brush workings indicates that further underground exploration is warranted along these fractures. Several assays of samples from the workings and ore pile were above commercial grade. Surface prospecting along the favorable horizon in the Dripping Spring quartzite should be directed with particular attention to the fracture systems. Bulldozing of soil- or talus-covered areas of the Dripping Spring quartzite is also recommended along projections of favorable linear trends that appear in the Troy quartzite and are visible on aerial photographs. (auth)

13922

RADIOACTIVITY IN GROUND AND SURFACE WATER. Sheldon Judson and J. Kenneth Osmond (Univ. of Wisconsin, Madison). Am. J. Sci. 253, 104-16(1955) Feb.

Values for the uranium content and total radioactivity of some underground and surface waters are presented for samples from 77 localities, largely in the United States. The uranium content for these samples ranges between 0.02ppb and 460ppb. The uranium content and total radioactivity of water from carnotite-bearing beds in the Grand Junction, Colorado area are spectacularly high when contrasted with values for water from non-mineralized beds. Uranium content and total radioactivity was determined from residues obtained by evaporation of water samples. The total radioactivity of these residues is shown to change through time. (auth)

13923

AN APPARATUS FOR THE STUDY OF THERMOLUMINESCENCE FROM MINERALS. G. E. Ashby and R. C. Kellagher (U. S. Geological Survey, Washington). Am. Mineralogist 43, 695-706(1958) July-Aug.

An apparatus has been constructed to record the thermoluminescence of a mineral in the form of a powder or a single crystal at temperatures from −100°C to +400°C. Glow curves are obtained by heating the sample at a constant rate and recording the intensity of thermoluminescence as a function of temperature. The apparatus has provision for the irradiation of the sample with x rays or ultraviolet light and for measurement of the induced luminescence during any part of the experiment. Upon termination of the irradiation the measurement of the luminescence can be continued at any desired temperature and rapidly decaying phosphorescence can be detected. In all these experiments the sample remains undisturbed, and the problems associated with the heterogeneity of the sample are thus reduced. (auth)

13924

FACTORS IN AGE DETERMINATION OF CARBONATE SEDIMENTS BY THERMOLUMINESCENCE. Edward J. Zeller (Univ. of Kansas, Lawrence); John L. Wray (Ohio Oil Co., Denver Research Center); and Farrington Daniels (Univ. of Wisconsin, Madison). Bull. Am. Assoc. Petrol. Geologists 41, 121-9(1957) Jan.

New data obtained from pressure experiments have shown that at least two genetic types of thermoluminescence exist and have furnished an objective means for the selection of limestone samples for age determination tests. The quantity of gamma radiation necessary to reproduce the natural thermoluminescence of a sample can be determined experimentally. When this value is divided by the natural radiation rate, an index is obtained which bears a linear relationship to geologic age. Possible sources of error have been recognized and their effects are discussed. (auth)

13925

ON THE RELATION BETWEEN EVEN AND ODD RARE EARTH ELEMENTS IN DIFFERENT MINERALS. R. L. Barinskii (Inst. of Mineralogy, Geochemistry and Crystal Chemistry of Rare Elements, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 120, 573-6(1958) May 21. (In Russian)

Investigations were made of the rare earth content in 30 different minerals (basically yttrium). A method of qualitative x-ray spectral analysis (by the secondary emission spectra) was developed for determining the content of 14 rare elements from La to Lu. Graphs of rare earth element distribution in pegmatite minerals and the relation between the even-odd elements in various minerals are plotted. (R.V.J.)

13926

SULFUR ISOTOPES AND THE ORIGIN OF SANDSTONE-TYPE URANIUM DEPOSITS. M. L. Jensen (Yale Univ., New Haven, Conn.). Econ. Geol. 53, 598-616(1958) Aug.

An isotopic study of sulfide minerals associated with sandstone-type uranium deposits of the Colorado Plateau and Wyoming indicates S^{32}/S^{34} ratios of these 57 samples varying between 21.93 to 23.32. The majority, however, exhibit ratios that are highly enriched in the lighter isotope compared to the ratio of primordial sulfur that is assumed to be similar in ratio to meteoritic troilites, which vary in ratio from 22.18 to 22.24. The samples are predominantly pyrite and marcasite, but chalcopyrite, covellite, and bornite are included, even though the sulfide mineral species appears to have no relationship to the specific ratio obtained. There is, furthermore, no indication of a difference between ratios obtained from sulfides collected within uranium ore zones in comparison to ratios of sulfides occurring in either adjacent or distant barren uranium ground. The formations (Triassic to Eocene) from which the samples were collected have no obvious correlation with the ratios, nor does the presence or absence of lignitic, woody, or other carbonaceous matter show any correlation with the ratios. The relatively broad spread of these high ratio values, especially of those samples collected from one deposit, is very suggestive of hydrogen sulfide derived from anerobic bacteria. It is suggested that sulfate waters (possibly both connate and meteoric in origin) in Mesozoic sediments of the Colorado Plateau area were reduced by anerobic bacteria to hydrogen sulfide when these waters encountered carbonaceous-rich zones that provided an environment and energy source for the bacteria. The hydrogen sulfide may have remained where formed or may have migrated to locales barren of carbonaceous matter, but most likely did both. At a later date, about 60 to 75 million years ago, ore solutions moving through these more porous and permeable channels encountered the very effective reducing agent, hydrogen sulfide, which brought about the concentration of uranium through precipitation of the soluble uranyl ions to relatively insoluble UO_2. At the same time iron (and in some cases

copper) sulfate was precipitated as relatively insoluble sulfides. (auth)

13927

THORIUM CONTENT OF OCEAN WATER. William M. Sackett and Herbert A. Potratz (Washington Univ., St. Louis) and Edward D. Goldberg (Univ. of California, La Jolla). Science 128, 204-5(1958) July 25.

Two samples of ocean water from the Pacific, one collected at the surface near the coast outside San Diego Bay in the summer of 1956 and the other taken at a depth of 3500 m from longitude 124° 41.0′ W, latitude 33° 54.5′ N on March 25, 1957, were analyzed for total thorium alpha activity. The method of analysis is described, and the results are tabulated. Some information concerning the approximate isotopic composition of the thorium which was isolated from the surface water sample was obtained by observing the change in its alpha activity with time. The observed activities and the calculated values are given and are in good agreement. (J.S.R.)

13928

GEOLOGY OF THE COPPER KING URANIUM MINE, LARIMER COUNTY, COLORADO. P. K. Sims, George Phair, and R. H. Moench. U. S. Geol. Survey Bull. 1032-D, 1958. 56p. and 3 illus. Available from Government Printing Office, Washington for $0.75.

The Copper King mine, in the Prairie Divide region of Larimer County, Colo., in the northern part of the Front Range of Colorado, was opened during World War I in an unsuccessful attempt to mine copper and zinc ore. In 1949, following the discovery of pitchblende on the dump, the mine was reopened; it was worked until 1953 for uranium. A total of 652 tons of ore that contained an average of 0.28 percent U_3O_8 was shipped; 622 tons of the ore was mined from an ore shoot opened under a Defense Minerals Exploration Administration contract. The uranium deposit consists of pitchblende and associated vein-forming minerals that occur in the Copper King fault and locally in pyrite boxwork adjacent to the fault. Three black, uranium-rich phases have been identified: uraninite, coffinite, and UO_3-rich pitchblende. Colored secondary minerals are absent. The pitchblende occurs in a steeply plunging, tabular shoot that is 45 to 135 feet below the surface and that has a horizontal length of about 50 feet. Within the shoot the pitchblende occurs in pods or layers that are generally a few feet in height and length and as much as a foot thick, and that are separated by nearly barren vein. The grade of the ore within the pods ranges from 0.2 percent uranium to as much as 20 percent but averages about 1 to 2 percent. Age determinations by the Pb^{206}/U^{238} and Pb^{207}/U^{235} methods on two samples of hard pitchblende from the vein, not from the pyrite boxwork, gave ages, after suitable common lead correction, ranging from 55 to 76 million years, corresponding to an early Tertiary age. Diamond-core drilling and reconnaissance for radioactivity have not disclosed other uranium deposits in the Prairie Divide region; nevertheless it seems likely that other deposits are present. (auth)

13929

PRELIMINARY GEOLOGIC MAP OF THE VERDURE 2 SE QUADRANGLE SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 163. Lyman C. Huff and Frank G. Lesure. Washington, U. S. Geological Survey, 1958. $0.50.

13930

GEOLOGIC MAP OF THE CASTLE BUTTE QUADRANGLE KERN COUNTY, CALIFORNIA. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 170. T. W. Dibblee, Jr. Washington, U. S. Geological Survey, 1958. $0.50.

Metals and Metallurgy

Refer also to abstracts 14426, 14428, 14429, 14430, 14431, 14432, 14433, 14435, and 14436.

13931 AECU-3623

Columbia Univ., New York. Engineering Research Labs.
FAST TRANSIENT HEATING AND EXPLOSION OF METALS UNDER STAGNANT LIQUIDS. A. J. Bendler, J. K. Roros, and N. H. Wagner. Feb. 12, 1958. 161p. Contract AT(30-3)-187. (CU-1-58-AT-187-Ch.E).

Thermal transients with total pulse times of 3 to 28 milliseconds were simulated by direct-current electrical heating in studies of the explosions of Ag, Al, Cu, Sn, U, Zn, and Zr specimens under water and under oil at an ambient temperature of 75°F and at atmospheric pressure. Motion pictures were taken of many of the explosions at film speeds of 7,500 to 14,500 frames/sec. A 600-foot composite reel was prepared which shows 7 representative explosions and views of the equipment. Data for 34 runs, photographs, and photomicrographs are presented and discussed with respect to burnout, heat transfer, and metal–water reaction. (auth)

13932 AECU-3798

Horizons, Inc., Cleveland.
INVESTIGATION OF PROCESSES FOR PREPARATION OF HIGH PURITY NIOBIUM METAL. Final Report [for] June 1, 1956 to May 31, 1958. Merle E. Sibert. June 15, 1958. 79p. Contract [AT(30-1)-1894]. $12.30(ph OTS); $4.50(mf OTS).

An electrorefining process has been developed for preparation of pure Nb by refining of crude Nb in a fused melt of K_2NbF_7 dissolved in a suitable alkali chloride. Conditions and results from the electrolysis are described for three scales of operation. Preparation of the anode feed material was accomplished by carbon reduction of Nb_2O_5. Thermite type reductions were also investigated, but are not satisfactory in this case. An investigation of equilibrium pressures for the system Nb(C)–Nb(O)–CO was also carried out to give some fundamental information on the anode preparation reaction. Equipment involved in the electrolysis, feed preparation, and the equilibrium study are also fully described. A soluble anode cell specifically designed for Nb electrorefining is described. The process as developed utilizing low oxygen anode feed material is capable of refining out carbon, nitrogen, hydrogen, tantalum, and most common metallic impurities to satisfactory levels. (auth)

13933 AECU-3801

Southern Research Inst., Birmingham, Ala.
THE DETERMINATION OF TRUE STRESS-TRUE STRAIN CURVES AND MODULUS OF ELASTICITY OF URANIUM-10 w/o MOLYBDENUM ALLOY AT ELEVATED TEMPERATURES. Final Report to Atomic Power Development Associates. Bryan McPherson. Mar. 28, 1958. 38p. $6.30(ph OTS); $3.00(mf OTS).

The true stress–true strain curves and modulus of elasticity were determined on a uranium–10 wt. % molybdenum alloy at room temperature and at 250, 500, 750, 1000, and 1250°F. The elevated temperature tests were conducted in a liquid bath to minimize oxidation effects. The test results indicated that the strength properties and modulus of elasticity of the uranium–

10 wt. % molybdenum alloy decreased with increasing temperature from room temperature to 1250°F. Up to 500°F, the true stress values increased with increasing true strain from the start of loading until the specimens failed. At higher temperatures, however, the true stress reached a maximum at an intermediate strain value before rupture, probably because of a tendency of the alloy to creep at a faster rate than the applied rate of strain. (auth)

13934 AECU-3814

Los Alamos Scientific Lab., N. Mex.

METALS FOR REACTOR APPLICATION AND LESS COMMON METALS. J. M. Taub. [1957]. 51p. Contract [W-7405-eng-36]. $9.30(ph OTS); $3.60(mf OTS).

The metallurgical properties of Be, Zr, Th, and U as reactor materials are summarized and discussed. (T.R.H.)

13935 BMI-1300

Battelle Memorial Inst., Columbus, Ohio.

CONSTITUTION OF URANIUM AND THORIUM ALLOYS. Frank A. Rough and Arthur A. Bauer. June 2, 1958. 138p. Contract W-7405-eng-92. $2.75(OTS).

A compilation of constitution diagrams of uranium and thorium alloys is presented. The transformation and melting temperatures of the base metal are discussed, followed by the various alloys in alphabetical order. References are included on each alloy. (J.R.D.)

13936 NAGA-TN-4286

Michigan. Univ., Ann Arbor.

MECHANISM OF BENEFICIAL EFFECTS OF BORON AND ZIRCONIUM ON CREEP-RUPTURE PROPERTIES OF A COMPLEX HEAT-RESISTANT ALLOY. R. F. Decker and J. W. Freeman. Aug. 1958. 54p.

The effects of the addition of small amounts of boron and zirconium on creep properties of an alloy containing 55 percent nickel, 20 percent chromium, and 15 percent cobalt, with molybdenum, titanium, and aluminum were studied. These additions improved the creep-rupture properties at 1,600°F because of a stablizing effect on the grain boundaries. These additions prolonged the life to fracture and allowed higher deformations before fracture. A number of optical and electron photomicrographs trace the development of microcracks and matrix changes through the creep process. (auth)

13937 NMI-4403

Nuclear Metals, Inc., Cambridge, Mass.

CORE-TO-CLAD INTERDIFFUSION STUDIES ON ZIRCONIUM-CLAD U–10 w/o Mo ALLOY FUEL PINS. L. R. Aronin and J. J. Pickett. Jan. 10, 1958. 18p. Contract AT(30-1)-1565. $3.30(ph OTS); $2.40(mf OTS).

The results of a metallographic study of interdiffusion behavior between the core and cladding of zirconium-clad molybdenum–uranium alloy fuel pins at temperatures from 950 to 1650°F are presented. (J.E.D.)

13938 NMI-4404

Nuclear Metals, Inc., Cambridge, Mass.

INVESTIGATION OF COEXTRUSION AS A METHOD OF PRODUCING TANTALUM–CLAD U–10 w/o Mo PIN-TYPE FUEL ELEMENTS. J. J. Pickett and L. R. Aronin. Jan. 23, 1958. 10p. $1.80(ph OTS); $1.80 (mf OTS).

The process of coextrusion followed by cold swaging was established as feasible for the production of pin-type fuel elements of U–10 wt. % Mo clad with tantalum. Fuel pins consisting of a 0.150-in. diameter U–10 wt. % Mo core with a 0.004-in. thickness of tantalum cladding were successfully produced in a limited experimental program. Coextrusion was accomplished at 1800°F from a 1.40-in. diameter liner in a 300-ton press. Good results were obtained on billet assemblies which were sealed into evacuated, heavy-walled, iron jackets and extruded with glass lubrication through 0.375-in. or 0.340-in. diameter dies (14× or 17× reduction). Cold swaging of extruded rods through reductions up to 61.5% was accomplished without difficulty. (auth)

13939 NP-6866

Cobalt Information Center, Columbus, Ohio.

COBALT AND ITS ALLOYS. A Summary on Allotropy and Phase Diagrams. Second Edition. F. R. Morral. Nov. 1956. Revised May 1958. 135p.

Available free of charge (Cobalt Information Center).

Phase diagrams are given for binary cobalt alloys. A summary of allotropy for binary, ternary, and quaternary cobalt alloys is presented. References are included on all alloys listed. (W.L.H.)

13940 NRL-5037

Naval Research Lab., Washington, D C.

TEMPERATURE AND STRESS DEPENDENCE OF THE ATMOSPHERE EFFECT ON NICHROME V. P. Shahinian and M. R. Achter. Sept. 19, 1957. 12p. Projects NR-510-000 and NR-510-007.

Creep rupture tests were performed in vacuum and in air on Nichrome V, a nickel–chromium alloy, at 1100, 1300, 1500, 1700, and 1900°F at a range of stresses. Although the alloy tends to be stronger in air than vacuum at high temperatures and low strain rates, the reverse is true at low temperatures and high strain rates. At stresses where the vacuum specimen has a longer rupture life, the creep rate of the air specimen may be lower at the start of the test but faster subsequently. A possible mechanism to explain these reversals involving two competing processes is considered. Comparison of the atmosphere effect on Nichrome and nickel are in accord with the difference in oxidation resistance. (auth)

13941 NYO-4684

Massachusetts Inst. of Tech., Cambridge.

THE SOLUBILITY OF IRON–NICKEL ALLOYS IN LIQUID LEAD–700 to 1100°C^{+}. B. Fleischer and J. F. Elliott. [1958]. 22p. Contract AT-30-1-1888. $4.80 (ph OTS); $2.70(mf OTS).

The solubility of iron and nickel in lead and iron–nickel alloys in lead between 700 and 1100°C was determined by an equilibration-sampling technique. The liquidus surface for the lead phase in this temperature range is reported. The nickel compositions are reasonably reliable, but the iron contents are somewhat uncertain, apparently because of sampling difficulties and analytical problems. The activity curves for nickel and iron in the Fe–Ni binary at 1100°C are estimated. The activity coefficients of nickel and iron in liquid lead at 1100°C are 7.6 and 800, respectively. The reference states are the pure components. (auth)

13942 USBM-C-12

Bureau of Mines. [Northwest Electrodevelopment Experiment Station], Albany, Oreg.

EVALUATION OF ALLEGHENY-LUDLUM ZIRCALOY 2 INGOT. Earl T. Hayes and Ray L. Carpenter. Nov. 17, 1954. Changed from OFFICIAL USE ONLY Nov. 9, 1956. 7p. $1.80(ph OTS); $1.80(mf OTS).

An evaluation was made on a section of a Zircaloy 2 ingot which had been melted by the Allegheny Ludlum Corp. The alloy content of the ingot conformed to the specifications for Zircaloy 2. Analyses for impurity

content showed that the amounts of copper and magnesium were above the limits. The manganese content, although high, was within the limit of the specification. The hardness of 179 Brinell is considerably higher than previously examined Allegheny Ludlum ingots. The ingot section was machined smooth, etched, and photographed. Hardness measurements were taken at various places on the etched surface. The slab was then cut in half. One half was used to prepare samples for chemical and spectrographic analyses, and the other half was rolled into sheet for corrosion testing. Since only a slab cut from the top portion of the ingot after the ingot had been machined to remove the outer layer of material was available for evaluation, no examination of the sidewall was made. (auth)

13943 WAPD-PWR-PMM-633

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. CALORIMETRIC DETERMINATION OF ORDERING IN THE U–Mo SYSTEM. R. F. Boyle and E. K. Halteman. [1956?]. 38p. $6.30(ph OTS); $3.00(mf OTS).

Specific heat measurements were made on a series of U–Mo samples with varying Mo content. The results indicate that ordering occurs in the U–Mo system. Measurement of the long-range order parameter S was made for one series of 15 wt.% Mo samples, and a plot of S vs. T is shown. The ordering behavior appears similar to that of AB_3 alloys. The U–Mo phase diagram presently accepted at Bettis was substantiated. (auth)

13944 AEC-tr-3335

INVESTIGATION OF THE INFLUENCE OF STRESS AND DEFORMATION ON THE SELF-DIFFUSION OF IRON. T. I. Gudkova, V. S. Gorbatov, S. Z. Bokshtein, A. A. Zhukovitskii, and S. T. Kishkin. Translated by Robert Misch (Argonne National Lab.) from Zavodskaya Lab. 23, 1438-9(1957). 4p.

A special apparatus was constructed to carry out a diffusion anneal in vacuum with certain tensile stresses acting on the specimen so that diffusion both in the elastic region and in different stages of plastic deformation could be investigated. The determination of self-diffusion constants was made by the absorption method. To reveal the character of the components in the diffusion process, the method of autoradiography was applied concurrently. The average coefficients of diffusion obtained at different stresses and deformations are tabulated. (A.C.)

13945 NP-tr-117

INFLUENCE OF URANIUM ON THE STRUCTURAL PROPERTIES, HARDENING AND RETENTION OF HARDNESS OF UNALLOYED STEELS. H. Bennek and C. G. Holzscheiter. Translated by N. Willis (U.K.A.E.A., Atomic Energy Research Establishment) from Arch. Eisenhüttenw. 9, 193-200(1935). 16p.

Alloying experiments with two kinds of ferro-uranium showed that low percentage ferro-uranium with small carbon contents allows the production of casts practically free of segregates and with a tolerable loss in the heat treatment; this is accomplished by adding the material in the form of small pieces to the well deoxidized melt in the crucible. Ferro-uranium with high carbon and high uranium contents is unsuitable owing to its poor solubility. The experimental casts were perfectly malleable in the range examined of up to 5% of uranium. By adding uranium to the carbon steels, two new components of the cast appeared and these were interpreted as uranium carbide. Tempering and annealing experiments indicated a certain solubility of the γ-mixed crystal for uranium, but this phenomenon has only restricted applicability, as melting phenomena already occur at relatively low temperatures. The depth of hardness is increased by the presence of uranium for the corresponding temperature of hardening, while the susceptibility to super-heating is somewhat reduced. Uranium behaves in the steel as a special carbide forming element, similar to chromium. The improvement of the mechanical properties of constructional steels by the presence of uranium is small. (auth)

13946

THE KINETICS OF THE MAGNESIUM REDUCTION PROCESS FOR ZIRCONIUM PRODUCTION. F. G. Reshetnikov and E. N. Oblomeev. Atomnaya Energ. 4, 349-53(1958) Apr. (In Russian)

Descriptions are given of the apparatus employed for studies of the rate of magnesium reduction processes in the production of zirconium. During the process the temperature of zirconium chloride did not exceed 330°C in the evaporator heated to 450°C. The mean rate of the reduction increased at a slower rate with a temperature rise from 760 to 850°C in the crucible than with a temperature rise from 460 to 490°C in the evaporator. Thus, the determining factors in the kinetics of the process of zirconium production are the temperature of the evaporator and the sublimation and pressure of zirconium chloride vapors. (tr-auth)

13947

ELECTROLYTIC DEPOSITION OF STRONG LAYERS OF U, Np, Pu, AND Am. G. I. Khlebnikov and E. P. Dergunov. Atomnaya Energ. 4, 376-7(1958) Apr. (In Russian)

Methods and practical conditions of electrolytic preparation of strong, fine layers (0.4 mg/cm^2) of U, Np, Pu, and Am are described. (R.V.J.)

13948

A QUANTITATIVE STUDY OF DENDRITIC HETEROGENEITY IN IRON ALLOYS. Christian de Beaulieu and Jean Philibert. Compt. rend. 246, 3615-18(1958) June 30. (In French)

The variation of the concentration between the dendrite axes and the interdendrite spaces, observable by autoradiography, can be determined precisely by exact analysis with the Castaing microanalyzer. The microphotometer can be calibrated by autoradiography. In the presence of carbon, the elements can be classified in the order of increasing heterogeneity as Mn, Cr, Mo, and As. (tr-auth)

13949

SUPERSTRUCTURE IN A TITANIUM–15% ALUMINUM ALLOY. Adrien Saulnier and Maurice Croutzeilles. Compt. rend. 246, 3622-5(1958) June 30. (In French)

Micrographic and electron diffraction studies on thin sections of a Ti–15% Al alloy have shown the existence of an ordered compact hexagonal phase with the parameters a = 5.77 A and c = 4.65 A. The phase is a superstructure of the Mg_3Cd type of the α solid solution. This phase is found in submicroscopic platelets, parallel to the $\{10\bar{1}0\}$ faces of the solid solution. (tr-auth)

13950

RELATION BETWEEN THE PURITY OF ALUMINUM AND ITS REACTIVITY TO CORROSIVE REAGENTS. Gérard Wyon and Paul Lacombe. Compt. rend. 246, 3625-8(1958) June 30. (In French)

The role of iron in the attack of aluminum by corrosive reagents appears important. To confirm this

hypothesis, a simple method for the purification by melting in a high vacuum and progressive solidification was tested. The analysis confirmed the efficiency of the iron removal. As a result, the sub-boundaries were no longer attacked by the corrosive reagents. (tr-auth)

13951

DISTRIBUTION AND DIFFUSION OF HYDROGEN IN IRON. Jacques Plusquellec, Pierre Azou, and Paul Bastien. Compt. rend. 246, 3628-31(1958) June 30. (In French)

The distribution and diffusion of hydrogen in iron during electrolysis was studied. It was established that the hydrogen is located in the plane of the (112) family, a position which agrees with previous experimental data. If the electrolysis is stopped for a period of time, a strong absorption of hydrogen occurs when the electrolysis is resumed. (J.S.R.)

13952

DETERMINATION OF DIFFUSION COEFFICIENTS AND STUDY OF THE KIRKENDALL EFFECT ON THE URANIUM–TITANIUM COUPLE. Yves Adda and Jean Philibert. Compt. rend. 247, 80-3(1958) July 7. (In French)

The concentration-penetration curves were established for the Ti–U diffusion couple between 950 and 1075°C. The coefficient of chemical diffusion was determined as a function of the concentration. The Kirkendall effect was studied quantitatively, and the coefficients of intrinsic diffusion were calculated for uranium and titanium. (tr-auth)

13953

VARIATIONS IN LENGTH AND DENSITY ACCOMPANYING THE ADSORPTION OF HYDROGEN BY ZIRCONIUM. Lucien Espagno, Pierre Azou, and Paul Bastien. Compt. rend. 247, 83-6(1958) July 7. (In French)

The adsorption of hydrogen by zirconium causes linear variation in the length and density of samples of the metal. These variations are sufficiently sharp and reproducible to be used for the determination of the gas content of zirconium. (tr-auth)

13954

THE USE OF VARIABLE COMPOSITION SPECIMENS IN THE INVESTIGATION OF EQUILIBRIUM DIAGRAMS FOR THREE-COMPONENT SYSTEMS. L. S. Palatnik and G. V. Fedorov (Lenin Khar'kov Polytechnical Inst.). Doklady Akad. Nauk S.S.S.R. 120, 79-82(1958) May 1. (In Russian)

Isothermal cross sections of constitution diagrams for specimens of variable composition Bi–Cu–Pb, Ag–Bi–Pb, and Bi–Pb–Sb were studied. (R.V.J.)

13955

THE EFFECT OF THE ATOMIC CONCENTRATION OF CHROMIUM, MOLYBDENUM, AND TUNGSTEN ON THE PROPERTIES OF SOLID NICKEL SOLUTIONS. I. I. Kornilov and N. T. Domotenko (Zhukovskii Military Air Force Engineering Academy). Doklady Akad. Nauk S.S.S.R. 120, 311-13(1958) May 11. (In Russian)

Differences in the solubility of chromium, molybdenum, and tungsten in nickel produced different effects on the properties of solid solutions of nickel. The regularities in the property changes in relation to the atomic concentrations of chromium, molybdenum, and tungsten were studied. (R.V.J.)

13956

X-RAY STRUCTURE STUDIES OF METALS AFTER ELECTRIC SPARK MACHINING. K. F. Starodubov and B. P. Kolesnik. Fiz. Metal. i Metalloved. 5, 434-41 (1958). (In Russian)

X-ray structure analysis, phase constitution, and microhardness of surface layers for more than 100 combinations of Mn, Nb, V, and Zr with Al, Bi, C, Cd, Cu, Fe, Ni, Pb, Sn, and Zn were studied following sparking machining. (R.V.J.)

13957

PHYSICAL FACTORS AFFECTING THE STRENGTHENING OF ALLOYED IRON. V. M. Golubkov, V. A. Il'ina, V. K. Kirtskaya, G. V. Kurdyumov, and M. D. Perkas (Central Research Inst. of Ferrous Metallurgy). Fiz. Metal. i Metalloved. 5, 465-83(1958). (In Russian)

Studies were made of physical factors which determine α strengthening in iron alloyed with C, Co, Cr, Mn, Mo, Nb, Ni, P, S, Si, Ti, V, and W. The strengthening produced by changes in the fine structure of α solid solution without changes in chemical composition is discussed. (R.V.J.)

13958

PROPERTIES AND STRUCTURE OF IRON–NICKEL ALLOYED WITH MOLYBDENUM, CHROMIUM, AND NIOBIUM. A. Z. Ivanushkina and B. G. Livshits. (Central Research Inst. of Ferrous Metallurgy). Fiz. Metal. i Metalloved. 5, 527-35(1958). (In Russian)

Electrical resistance and microstructure of Fe–Nb–Ni and Fe–Mo–Ni alloys after various thermal treatments were studied. The single phase and double phase alloys were investigated. (R.V.J.)

13959

ANNEAL STAINLESS TUBING FOR CORROSIVE USE. J. S. Adelson (Republic Steel Corp., Cleveland). Iron Age 182, No. 6, 83-5(1958) Aug. 7.

The main causes of failure in stainless steel tubes are intergranular corrosion, stress-corrosion cracking, and pitting. For this reason tubing made from 300 series stainless steels should be given a final solution heat treatment at 1850 to 2050°F after welding or cold forming. The use of a bright annealing furnace for heat treatment so that the original smooth tubing surface is retained is recommended. It is pointed out that the prevention of failures in handling corrosive materials offsets the extra cost of the annealed product. (J.R.D.)

13960

DIFFUSION IN NICKEL–CHROMIUM–TITANIUM ALLOYS. A. Y. Shinyaev (Baikov Inst. of Metallurgy, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R. Otdel Tekh. Nauk No. 2, 143-5(1958) Feb. (In Russian)

Diffusion in Ni–Cr–Ti alloys was studied in relation to the content of titanium. Alloys with Ti content of 1.25, 3.45, and 7 wt.% and constant chromium content (20 wt.%) were treated at 995 to 1250°C, and coefficients of diffusion and activation energy for each alloy were tabulated. (R.V.J.)

13961

THE CONSTITUTION DIAGRAM OF COPPER–TITANIUM ALLOYS. V. N. Vigdorovich, A. N. Krestovnikov, and M. V. Maltsev. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 2, 145-8(1958) Feb. (In Russian)

The presence of the eutectic transition $L \rightarrow \alpha + \beta$ at the temperature 870 ± 1°C was determined by thermal analysis and zone recrystallization. The composition at the eutectic point is 17.1% Ti. The diffusion of titanium in copper determined by the microhardness

method showed the maximum diffusion at the eutectic temperature was 7.4% Ti. The microhardness was found to be 370 ± 15 kg/mm$_2$. The constitution diagram for Cu–Ti up to 20% Ti is included. (R.V.J.)

13962

THE STRUCTURE AND PHASE COMPOSITION OF DIFFUSION PLATING ON CHROMIUM ALLOY BY SILICON AND BERYLLIUM. P. M. Arzhanyi and L. N. Belyakov. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 2, 149-52(1958) Feb. (In Russian)

The structure and phase composition of the alloy (60% and 40% Fe) saturated with silicon and beryllium, in the solid phase, at 950 to 1200°C were investigated for times from 30 min to 15 hr. (R.V.J.)

13963

EFFECTS OF ALLOYING ADMIXTURES ON THE RECRYSTALLIZATION TEMPERATURE AND MECHANICAL PROPERTIES OF TITANIUM. E. M. Savitskii, M. A. Tylkina, and I. A. Tsyganova. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 3, 96-103(1958) Mar. (In Russian)

The effects of N up to 23% Be, B, C, and O up to 1.5% Al, Co, Cr, Fe, Mn, Nb, Re, and Sn up to 10%, and V up to 30% on the recrystallization temperature and mechanical properties of titanium iodide were investigated. (R.V.J.)

13964

APPLICATIONS OF MICROHARDNESS METHOD IN THE INVESTIGATION OF TERNARY COMPONENT SYSTEMS. V. N. Vigdorovich, A. N. Krestovnikov, and M. V. Maltsev (Kalinin Inst. of Non-Ferrous Metals and Gold). Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 3, 110-13(1958) Mar. (In Russian)

The effective applications of microhardness methods for the determination of maximum diffusion in solid solutions, linear changes in microhardness according to composition, and relative hardening caused by aluminum and titanium diffusion in copper were demonstrated with initial materials of Al–Cu (50% Al), Cu–Ti (14.7% Ti), and Al–Cu–Ti at various temperatures. (R.V.J.)

13965

BETA PHASE PROPERTIES OF ALUMINUM–NICKEL SYSTEM. L. N. Guseva and B. I. Ovechkin. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 3, 118-19 (1958) Mar. (In Russian)

The hardness of Al–Ni alloys was studied with cast specimens prepared by electrolytic fusion of 99.9% pure Ni and Al. The x-ray phase analysis and microstructure studies shows that all melts had a single phase structure. The hardness and electric resistance were found to be at a minimum near the stoichiometric point. With increased nickel or aluminum content the hardness and electric resistance increased. (R.V.J.)

13966

"SUPERPLASTICITY" IN ALUMINUM–COPPER ALLOY. A. A. Presnyakov and V. V. Chervyakova. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 3, 120-1(1958) Mar. (In Russian)

Superplasticity of eutectic cast Al–Cu alloy at temperatures close to liquidus was assumed to result from the structural eutectics and the temperature effects on copper diffusion. (R.V.J.)

13967

EFFECTS OF ADMIXTURES ON ELECTRIC PROPERTIES OF RUTILE. Ya. M. Ksendzov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 237-48(1958) Mar. (In Russian)

It was revealed that admixtures with higher valancy and radius than titanium affect the electric conductivity of TiO_2. Such admixtures form F centers, and the energy spectra of the extra valance electrons can be calculated. The polarization introduced by the admixture centers has a resonance mechanism. The resonance frequency corresponds to the frequency of electron exchange between the admixture centers and depends only on the atomic concentration of the admixtures and on the electron orbit radii. (R.V.J.)

13968

THE NIOBIUM–HYDROGEN SYSTEM. C. Wainwright (National Physical Lab., Teddington, Middlesex, Eng.). J. Inst. Metals 86, 68-9(1958) July.

A number of x-ray photographs were obtained from heavily cold-worked samples, and these show the short intense arcs which are typical of highly orientated material. It is found that when sufficient hydrogen is introduced into such samples to show hydride lines, the additional lines reproduce the orientations of the matrix. This relationship is in accordance with Brauer's analysis, and with the development of the hydride phase by deformation of the niobium lattice, rather than by the nucleation and growth of independent crystals. It also suggests that highly worked samples may serve more generally to demonstrate such relationships in ductile materials, when single crystals are not available for full analysis. (auth)

13969

A REDETERMINATION OF THE LIQUIDUS OF THE SYSTEM LEAD–MAGNESIUM IN THE RANGE 0-3 WEIGHT PER CENT. MAGNESIUM. G. W. Horsley and J. T. Maskrey (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inst. Metals 86, 446-8(1958) June.

The determination was carried out by thermal, metallographic, and chemical analysis. The composition of the eutectic lies between 2.25 and 2.30 wt. % magnesium, and its melting point is estimated to be 248.5° ± 0.25°C. (auth)

13970

THE MARTENSITE TRANSFORMATIONS OF THE BETA PHASE IN COPPER–ALUMINUM–NICKEL ALLOYS. D. Hull (Atomic Energy Research Establishment, Harwell, Berks, Eng.) and R. D. Garwood (University Coll., Cardiff, Eng.). J. Inst. Metals 86, 485-92(1958) July.

Two types of martensite transformation of the metastable β phase have been observed in an alloy containing copper 79.5, aluminum 12.8, and nickel 7.7%. When the quenched alloy is cooled to 0°C, the plates formed are relatively fine and free from substructure (β'), but on tempering the quenched alloy and subsequent cooling to room temperature, a coarse-grained product (γ'), with a distinct secondary structure, is formed. Both types of martensite form isothermally when the alloy is aged at room temperature after a suitable heat-treatment This fact and the conditioning of the β phase for transformation into γ' martensite, which occurs during tempering, are thought to be due to the growth of the ordered domains of the Cu_3Al superlattice. The shear angle of the associated shape deformation is different for the two martensitic products $(\beta')\gamma_\theta = 9.5°$, $(\gamma')\gamma_\theta = 5.2°$, but in both cases the direction of shear is close to $[0\bar{1}1]_\beta$ for habit planes of the form $(1kk)_\beta$ and

$(\bar{1}kk)_\beta$. Under suitable conditions, a crystal of the parent β phase transformed into γ' martensite by the passage of a single interface. This mode of transformation was not observed for the β' martensite, owing to the larger angle of shear of the shape deformation. (auth)

13971

CONSTITUTION AND MAGNETIC PROPERTIES OF IRON-RICH IRON–ALUMINUM ALLOYS. A. Taylor and R. M. Jones (Westinghouse Research Labs., Pittsburgh). Phys. and Chem. Solids 6, 16-37(1958) July.

The constitution of high-purity iron–aluminum alloys over the composition range 0 to 62 at.% aluminum was investigated, primarily by x-ray diffraction methods. New lattice-parameter data were obtained which differ significantly from the classical results obtained by Bradley and Jay nearly 25 years ago. Diffraction patterns taken at elevated temperatures show that the phase diagram needs correction in the region of Fe_3Al, along with the further addition of a sloping transformation boundary beyond 18% aluminum. According to the results, alloys in the composition range 18 to 33% aluminum undergo a classical phase change and, on heating, pass successively from the Fe_3Al type of atomic ordering to the FeAl type. As the temperature is still further raised, anti-phase nuclei form, and finally the atomic arrangement becomes either a random one or one possessing short-range order. Alloys containing more than 37.5 at.% aluminum retain the FeAl type of order all the way up to the melting point. Anomalies in the lattice parameters, magnetic behavior, and thermal expansion of alloys in the region of Fe_3Al can be interpreted in the light of these structural changes. It has been found that cold working alloys containing aluminum in excess of 20 at.% increases the magnetic saturation moment and also the lattice parameter. In the region of Fe_2Al, the resulting increase in volume on cold working approaches 3%, and FeAl, which is virtually nonmagnetic at absolute zero, becomes appreciably ferromagnetic after sever grinding. A ferromagnetic face-centered cubic phase structure, probably based on Fe_3AlC, is found associated with alloys lying in the approximate composition range 10 to 33 at.% aluminum. Lattice-parameter measurements indicate the possibility of an epitaxial relationship between the body-centered cubic matrix and the face-centered structure. There are indications that this "extra" phase structure undergoes an order-disorder transformation. The high-temperature Fe_3Al_5 ϵ-phase which exists above 1103°C was found to be orthorhombic. (auth)

13972

THE MAGNETIC STRUCTURE OF Fe_3Al. R. Nathans (Pennsylvania State Univ., University Park and Brookhaven National Lab., Upton, N. Y.), M. T. Pigott (Pennsylvania State Univ., University Park); and C. G. Shull (Massachusetts Inst. of Tech., Cambridge). Phys. and Chem. Solids 6, 38-42(1958) July.

A polarized-neutron-beam spectrometer was used to determine the room-temperature magnetic structure of ordered Fe_3Al. The results show that the aluminum atoms possess no magnetic moment and that the iron moments differ for the two sublattice sites. On one sublattice, where the iron atoms are surrounded by both iron and aluminum nearest neighbors, the average moment/atom is found to be $1.46 \pm 0.1\ \mu_B$. On the other sublattice, where the iron atoms have only iron atoms as nearest neighbors, the average moment/atom is found to be $2.14 \pm 0.1\ \mu_B$. The data taken on higher-order magnetic reflections also permitted a comparison of the magnetic form factors for each of the different sites with that of metallic iron. No difference was observed to within the ±2% accuracy of the measurements on the form factor. (auth)

13973

SINTERING METHOD FOR SEMICONDUCTOR MATERIAL. Gerhart K. Gaulé, James T. Breslin, and John R. Pastore (U. S. Army Signal Research and Development Lab., Fort Monmouth, N. J.). Rev. Sci. Instr. 29, 565-7(1958) July.

A sintering process has been developed which makes it possible to utilize semiconductor material which comes in the form of small grains or small dendrite-like pieces. When pressure, alternating current, and an r-f field are applied, this loose material is sintered into rods without using a binder. These rods are used as "feed" for a floating zone apparatus. (auth)

13974

A NOTE ON PREFERRED ORIENTATIONS IN URANIUM AS DETERMINED BY DILATOMETRIC STUDIES. Steinar Aas (Joint Establishment for Nuclear Energy, Kjeller, Norway). Tidsskr. Kjemi Bergvesen Met. No. 5, 3p.(1957).

Uranium metal was reduced 80% in thickness by rolling. The thermal dilations of the finished plates were determined and correlated with theoretical dilations, calculated by assuming various types and degress of preferred orientations. The results confirm that a (010)–(110) double texture develops at rolling temperatures just below the recrystallization point. β-treatment does not give completely randomly oriented metal. Cross rolling changes the developed textures which are again dependent upon the exact rolling schedule. (auth)

13975

THE STRUCTURE OF NICKEL ELECTRODEPOSITS IN RELATION TO SOME PHYSICAL PROPERTIES. D. J. Evans (University Coll. of Swansea, Eng.). Trans. Faraday Soc. 54, 1086-91(1958) July.

It is considered that the investigation of possible relationships between the preferred orientations found in electrodeposits and factors such as internal stress, grain size and hardness is necessary for the eventual elucidation of the basic problem of the cause of the various preferred orientations. The structures of a variety of nickel electrodeposits and their relationships to some physical properties have been investigated, particular reference being paid to preferred orientation, internal stress, grain size, hardness, surface topography, and brightness. [100] and [110] were the predominant fiber axes found in matt, semi-bright, and bright deposits, and for any given electrolyte [110] was found to be associated with the higher values of internal stress and hardness, while [100] was associated with decreased values. The experimental evidence indicates that the brightness was not due to small grain size but merely to the free surface of the grains being flat and parallel to the general surface direction of the specimen; the fact that the deposits also show a high degree of preferred orientation is incidental and not the cause of the brightness. (auth)

13976

OBSERVATIONS ON MICROCRACK FORMATION IN HYDROGEN-EMBRITTLED ZIRCONIUM. A. P. Young and C. M. Schwartz (Battelle Memorial Inst., Columbus, Ohio). Trans. Met. Soc. AIME 212, 309-10(1958) June.

To understand the relationship of the hydride precipi-

tate to the strain rate effect in tensile samples, the surfaces of chemically polished Zr tensile samples strained at a slow rate and at an impact rate were examined in optical and electron microscopes. The apparent difference between slow-strain and impact tensile samples was the preponderance of twinning over slip in impact samples as compared to relatively little twinning in slow-strain samples. (auth)

13977

THE ELECTROLYTIC PREPARATION OF MOLYBDENUM FROM FUSED SALTS. V. ELECTROREFINING STUDIES IN THE PRESENCE OF TIN, IRON, COPPER, SILICON AND NICKEL. D. E. Couch (National Bureau of Standards, Washington) and Seymour Senderoff (National Carbon Research Labs., Parma, Ohio). Trans. Met. Soc. AIME 212, 320-5(1958) June.

The cathodic processes in the electrorefining of molybdenum from a fused chloride bath were studied. The results show that the best refining efficiency was obtained by operating the baths at 900°C and with current densities of 3 to 30 amp per dm^2. Temperature was found to be the most critical variable. The effects of stannous chloride, ferrous chloride, silica, sodium fluosilicate, cuprous chloride, and nickel chloride upon the cathode deposit were determined. (auth)

13978

THE LAVES PHASES $ThOs_2$ AND $ThIr_2$. A. E. Dwight, J. W. Downey, and R. A. Conner, Jr. (Argonne National Lab., Lemont, Ill.). Trans. Met. Soc. AIME 212, 337-8 (1958) June.

The $MgCu_2$ type Laves phase was observed in the thorium–osmium and thorium–iridium system. The two alloys corresponding to $ThOs_2$ and $ThIr_2$ were prepared by arc melting a 5-g charge in a water-cooled copper crucible. Both alloys were brittle. X-ray-diffraction patterns were obtained using filtered copper and cobalt radiation with a Straumans-type De Bye-Scherrer camera. The values of a_0 were obtained by a Nelson-Riley extrapolation. (auth)

13979

THE EQUILIBRIUM DIAGRAM OF INDIUM–ZIRCONIUM IN THE REGION 0-26 AT. PCT In. J. O. Betterton, Jr. (Oak Ridge National Lab., Tenn.) and W. K. Noyce (Univ. of Arkansas). Trans. Met. Soc. AIME 212, 340-2(1958) June.

The zirconium-rich portion of the indium–zirconium phase diagram was determined as a study of the effect of alloying a trivalent B-sub group element, indium, with zirconium in Group IVA. The temperature of the allotropic transition was found to rise with indium, terminating in a peritectoid reaction, β (9.3% In) + γ (22.4% In) $\rightleftharpoons$ α (10.1% In) at 1003°C. In this respect the effect of indium is analogous to that of aluminum in zirconium and titanium alloys. (auth)

13980

THE SELECTIVE IDENTIFICATION OF CONSTITUENTS IN NIMONIC 80 BY EXTRACTION-REPLICA TECHNIQUE. J. R. Mihalisin (International Nickel Co., Bayonne, N. J.). Trans. Met. Soc. AIME 212, 349-50 (1958) June.

The extraction-replica technique allows phases of high-temperature alloys to be examined in situ in the microstructure and permits their identification by means of electron diffractions. This technique eliminates the disadvantage in using electrolytic extraction of residues as a means of phase identification. (J.E.D.)

13981

GRAIN-BOUNDARY SLIDING AND MIGRATION IN HIGH-PURITY ALUMINUM AT ROOM TEMPERATURE. F. B. Cuff, Jr. and N. J. Grant (Massachusetts Inst. of Technology, Cambridge). Trans. Met. Soc. AIME 212, 355-6(1958) June.

This investigation was concerned with an electron-microscopic study of a fine network that appeared on the surface of chemically polished high-purity aluminum. (J.E.D.)

13982

FORMATION OF LARGE GRAINS OF ALPHA TITANIUM BY ZONE MELTING. F. J. Darnell (E. I. du Pont de Nemours and Co., Wilmington, Del.). Trans. Met. Soc. AIME 212, 356-7(1958) June.

The formation of large grains was accomplished by using iodide titanium as starting material. Determination of the single-crystal nature of the titanium was made by metallographic examination of etched surfaces and x-ray back-reflection studies. The effectiveness of the method in producing large grains is believed due to the small temperature interval in which the β-α transition can occur. (J.E.D.)

13983

HARDNESS OF SINGLE CRYSTALS OF HIGH-PURITY ALPHA TITANIUM. J. L. Gissy, J. B. Schroder, and G. H. Schippereit (Battelle Memorial Inst., Columbus, Ohio). Trans. Met. Soc. AIME 212, 360-1(1958) June.

A difference in hardness exists between the basal and prismatic planes of alpha Ti. The hardness measured on the prismatic plane depends upon the orientation of the hardness indentor with respect to the unique axis of the crystal. The maximum hardness was observed when the long axis of the indentor was perpendicular to the unique axis. (auth)

13984

THE ELEVATED TEMPERATURE CHARACTERISTICS OF INTERNALLY OXIDIZED TITANIUM–CERIUM ALLOYS. R. H. Hiltz, Jr. and N. J. Grant (Massachusetts Inst. of Tech., Cambridge). Trans. Met. Soc. AIME 212, 383-7(1958) June.

Solid-solution titanium–cerium alloys, cold-rolled to 0.010 in. thickness, and annealed, were internally oxidized to produce a fine dispersion of CeO_2 in the titanium matrix. The oxidized alloys were cut into sheet stress-rupture specimens and tested for rupture life at 426, 538, and 648°C. There was noted an improvement in strength over that of pure titanium, the internally-oxidized alloys showing curves with a much flatter slope on the log stress—log rupture life plot, characteristic of the stable metal–metal oxide class of alloy. (auth)

13985

URANIUM–COLUMBIUM ALLOY DIAGRAM. B. A. Rogers, D. F. Atkins, E. J. Manthos, and M. E. Kirkpatrick (Iowa State Coll., Ames.). Trans. Met. Soc. AIME 212, 387-93(1958) June.

A phase diagram of the niobium–uranium alloys is presented. The apparatus and the procedures used in obtaining the data are described. Data from which the diagram was drawn are given in tabular and graphic form. (auth)

13986

THE SYSTEM MERCURY–THORIUM. R. F. Domagala, R. P. Elliott, and W. Rostoker (Illinois Inst. of Tech., Chicago). Trans. Met. Soc. AIME 212, 393-5(1958) June.

The phase equilibria of the Hg–Th system over the composition range 0 to 100% Th and temperatures up to 1000°C have been studied for a small-volume, closed system. The solubility of Th in liquid Hg is about 5% at

300°C and decreases sharply with decreasing temperature. Two intermediate phases occur, Hg_3Th and HgTh. The structures of these are hexagonal (nonideally close-packed) and face-centered cubic, respectively. The HgTh phase decomposes eutectoidally at 400 to 500°C. The solubility of Hg in solid thorium seems to be negligible. (auth)

13987

SHOCK-INDUCED MARTENSITIC TRANSFORMATION. R. E. Cech and D. Turnbull (General Electric Co., Schenectady, N. Y.). Trans. Met. Soc. AIME 212, 395-7 (1958) June.

Small particles, 10–20 μ diam., of a 28.6 at.% nickel, balance iron alloy, have been supercooled 186°C with respect to bulk alloy M. temperature. Particles exhibit a marked mechanical shock sensitivity while being held in a supercooled state. The tendency for shock to induce martensitic transformation appears to be a maximum at −140 to −160°. Slow cooling of particles in mechanical contact with one another results in extensive martensite formation. This is probably the same effect as the catalytic effect observed in polycrystals where martensite formation in one grain induces transformation in other grains. (auth)

13988

A BORON STEEL FOR DEEP DRAWING. L. R. Shoenberger (Jones and Laughlin Steel Corp., Pittsburgh). Trans. Met. Soc. AIME 212, 402-5(1958) June.

Boron has been used to produce nonaging low-carbon sheet steel. Retention of the necessary minimum amount of about 0.006% partially killed the steel. Amounts exceeding about 0.012% increased the degree of deoxidation, piping tendencies, and possibility of hot tearing in primary rolling. Semikilled practice resulted in good ingot yields and satisfactory surface quality. Aluminum added with the boron provided a protective deoxidizer. Good drawability was indicated by performances of the steel in a limited number of deep-drawing trials. Some problems with hot-tearing and boron-analysis procedures were overcome. Metallographically, the boron semikilled steels revealed some structures not usually found in plain low-carbon steels. (auth)

13989

THE EFFECT OF WELDING SPEED ON STRENGTH OF 6061-T4 ALUMINUM JOINTS. William L. Burch (Bell Aircraft Corp., Buffalo, N. Y.). Welding J. (N. Y.) 37, 361s-7s(1958) Aug.

The factors affecting tensile strength of welded-and-aged 6061-T4 aluminum joints were studied. It was found practicable to weld, by the inert-gas-shielded tungsten-arc process, joints which upon aging had nearly the strength of 6061-T6. On large airborne tanks this technique was valuable because it avoided solution heat treatment of the finished structure and attendant quenching and distortion problems. Welds were single pass in 1/16-, 1/8-, and 1/4-in. thickness. Welding heat was most harmful at an overaged zone in the base metal 1/4 in. from the weld; tensile failure usually was here. The overaged zone reached a peak temperature of about 700°F regardless of welding speed. The intensity of overaging depended upon the time this zone was in the 570 to 700°F range. This time was inversely proportional to the welding speed. Of the many factors studied, welding speed was the most important one affecting response to aging. Slow speeds caused high heat input, practically annealing the base metal. With increasing speeds the joint strength increased rapidly up to a speed of 15 ipm, above which the tensile strength was uniformly high at 90 to 95% of -T6 strength. (auth)

13990

DETERMINATION OF THE THERMODYNAMIC ACTIVITIES ACCORDING TO A VAPOR PRESSURE COMPARISON METHOD IN THE CASE OF LIQUID GALLIUM–CADMIUM ALLOYS. Bruno Predel (Universität Münster, Westfalen, Germany). Z. Metallk. 49, 226-31 (1958) May. (In German)

A method is presented for the determination of the vapor pressure of systems in which the vapor pressure of the non-volatile component is so small that it doesn't distill in a noticeable amount. The method was used to determine the thermodynamic behavior of cadmium in the cadmium–gallium system over the full concentration range between 426 and 595°C. The results are discussed. (auth)

13991

THE TERNARY SYSTEM NICKEL–PALLADIUM–MANGANESE. Werner Köster and Mohamed Sallam (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk. 49, 240-8(1958) May. (In German)

The ternary system palladium-nickel-manganese was investigated by metallographic methods, thermal analysis and magnetic, dilatometric, and x-ray measurements. The melting curves, the planes of primary crystallization, and the reactions in solid phase are given. The arrangement of the phase regions was obtained from isothermal sections at 950, 820, 700, 650, 600, and 500°C and from three temperature concentration-sections. For six ternary alloys with 10% manganese some physical properties have been measured as functions of heat treatment. (auth)

13992

CRITICAL ANALYSIS ON THE ORIGIN OF SPHERIC GRAPHITE IN CAST IRON. Erich Scheil (Max-Planck-Institut für Metallforschung, Stuttgart) and Adalbert Wittmoser (Versuchsanstalt der Eisenwerke Gelsenkirchen AG, Gelsenkirchen, Germany). Z. Metallk. 49, 256-67(1958) May. (In German)

A review is presented on investigations of the development of spheric graphite in cast iron. The various hypotheses are compared and analyzed. 45 references. (J.S.R.)

13993

INVESTIGATION ON THE ATTACK OF NICKEL AND ALLOYS BY SULFUR. Irmtraud Pfeiffer (Laboratorium der Vacuumschmelze, AG, Hanau/Main, Germany). Z. Metallk. 49, 267-75(1958) May. (In German)

The kinetics and the reaction mechanism of sulfidation are investigated for pure nickel and nickel alloyed with aluminum, beryllium, and manganese. From microscopic studies some information can be obtained on the formation of the outer sulfide layers, and platinum mark tests give information on the transport of matter. The differences between intercrystalline corrosion in pure nickel and in nickel alloys are pointed out and explained. (auth)

13994

X-RAY INVESTIGATION OF THE AGE HARDENING OF AN ALUMINUM–MAGNESIUM–ZINC ALLOY. Hermann Schmalzried and Volkmar Gerold (Max-Planck-Institut für Metallforschung and Technischen Hochschule, Stuttgart). Z. Metallk. 49, 291-301(1958) June. (In German)

X-ray investigations of the age hardening process in an aluminum–magnesium–zinc alloy (6.3% Mg,

3.5% Zn) show that below 130°C clustering of magnesium and zinc atoms occurs in ordered layers parallel to (001) planes. The limitation of the cluster size to an average diameter of about 25 A is due to lattice straining caused by the clustering. Above 80°C an intermediate hexagonal phase η ($MgZn_2$) with two different orientations $(10.0)_\eta \parallel (100)_\alpha$; $[00.1]_\eta \parallel [011]_\alpha$ and $(10.0)_\eta \parallel (1\bar{1}0)_\alpha$ or $(10.0)_\eta \parallel (11\bar{2})_\alpha$; $[00.1]_\eta \parallel [111]_\alpha$ is precipitated. Above 190°C precipitation of the stable, ternary cubic phase T ($Al_2Mg_3Zn_3$) with the orientation $(100)_T \parallel (112)_\alpha$; $[001]_T \parallel [1\bar{1}0]_\alpha$ takes place. (auth)

13995

PROCEDURE FOR THE IMPROVEMENT OF VARIOUS PROPERTIES OF Al–Mg ALLOYS. Hermann Kessler (Laboratorium der Aluminiumwerke, Nuremberg). Z. Metallk. 49, 312-16(1958) June. (In German)

A new process was developed for influencing the structure of aluminum-magnesium casting alloys. By means of carrier gases, carbonchlorides are introduced into the metal melt where they are dissociated. The carbon liberated reacts with the alloying constituents titanium and boron, forming numerous and evenly distributed titanium-carbide and titanium-diboride nuclei which effect a particularly fine-grained structure of the melt on solidification. The chlorine gas in the nascent state contributes to the purification and degassing of the melt. As carrier gas, nitrogen is used to advantage. The liberated chlorine gas and the carrier gas counteract gravity segregation of the nuclei in the melt and favor their uniform distribution. By an uniform grain refinement the mechanical properties of aluminum-magnesium alloys, such as yield strength, tensile strength, elongation, hardness, notched bare impact strength, and rotating-bending fatigue strength are improved considerably. It is especially important to note that the tensile strength remains approximately the same over the temperature range from 20 to 300°C and that there is no difference between the values determined on separately cast test bars and bars cut from a casting. Experience gained in developing this process shows that by this method it is possible to develop alloys of far better high temperature stability than by simply adding further alloying constituents. It might be of advantage to extend these new findings also to other types of alloys, as they already stood their test in the case of aluminum-silicon casting alloys where other nuclei-forming substances have been used. (auth)

13996

INVESTIGATIONS ON THE GRAIN BOUNDARY BRITTLENESS IN THE COMPLICATED DIE PRESSING OF THE INDUSTRIAL MATERIAL AlZnCuMg 0.5. Wilhelm Rosenkranz. Z. Metallk. 49, 316-23(1958) June. (In German)

During manufacturing of complicated die-pressings of AlZnCuMg 0.5 (W 3425) and of other aluminum-alloys, a fish-scale like structure occurs in plate shaped regions after warmhardening and leads to intercrystalline fractures. This fish-scale structure can be avoided by prevention of spontaneous recrystallization during deformation and application of higher ageing temperatures. Recrystallization may be prevented by additions of iron, manganese, and chromium. (auth)

13997

LATTICE STRAINS AND INTERNAL STRESSES OF PURE AND ALLOYED ALUMINUM SAMPLES AFTER TENSILE DEFORMATION. Eckard Macherauch and Paul Müller (Max-Planck-Institut für Metallforschung and Technischen Hochschule, Stuttgart). Z. Metallk. 49, 324-31(1958) June. (In German)

X-ray measurements with Cu radiation were made on polycrystals of high purity aluminum and an aluminum alloy of the duralumin type. The connection between residual lattice strains and residual stresses in the surface of the specimens was investigated. The difficulties of adjoining residual stresses to x-ray measurements of residual strains were discussed. The measurements on high purity aluminum showed, that a theory by G. B. Greenough, claiming a pure stress state of the second kind after uniaxial plastic deformation, was not true. The residual strains showed a behavior, which, in approximation, was characteristic for pressure stresses of the first kind. The results pointed to an extended surface-effect, but did not exclude an additional yield-point effect. The residual stresses increased with growing deformation in the same way as the stress-strain diagram of the test material, if the latter was reduced by a factor 0.4. In the alloy of the duralumin type, similar results were found. After tensile deformation a strain state was found as, in good approximation, it was characteristic for a biaxial state of residual pressure stresses. The surface effect seemed to prevail. The dependance of the residual stresses on the deformation was the same as in high purity aluminum. The factor of adaption to the stress-strain diagram was 0.6. (auth)

13998

NEW INVESTIGATION ON THE SUB-GRAINS IN ALUMINUM. Dietrich Altenpohl. Z. Metallk. 49, 331-42 (1958) June. (In German)

The occurence of sub-grains in various stages of aluminum processing is investigated by x rays and by light and electron microscope. The results are discussed. They indicate that there is an enrichment of foreign atoms in the substructures, especially of iron and hydrogen and possibly of copper also. (auth)

13999

X-RAY FINE STRUCTURE INVESTIGATION ON SCALE COVERS OF AN IRON–ALUMINUM SINTER METAL. Franz M. Oberhauser. Z. Metallk. 49, 343-5(1958) June. (In German)

Scale covers on iron-aluminum sinter metal (12 to 14% Al) were investigated by x rays. At 1350° granular scale covers of α-Fe_2O_3 are formed. At 1200° the scale cover consists of a fine granular Fe_3O_4 intermediate layer and an outer layer of α-Fe_2O_3 and Fe_3O_4. For explanation it is assumed that each grain oxidizes separately. The predominance of certain stages of oxidation in the scale covers follows from the strong temperature dependence of the rates of diffusion and reaction. (auth)

14000

CALORIMETRIC INVESTIGATION OF TRANSFORMATIONS IN COPPER–BERYLLIUM. Bernhard Ilschner (Max-Planck-Institut fur Eisenforschung, Düsseldorf). Z. Metallk. 49, 349-56(1958) July. (In German)

The microcalorimetric method was applied to the investigation of the transformation process in a beryllium–copper alloy with 1.65 wt. % beryllium. The results are given for measurements made in the temperature range from 100 to 360°C. A master curve representation is given as an illustration of the uniformity of the transformation mechanism at all temperatures investigated. The total heat effects and the activation energies involved are discussed. The ki-

netics of the transformations observed are described. (J.S.R.)

14001

REMARKS ON THE PHASE DIAGRAM OF LEAD–INDIUM. Siegfried Valentiner. Z. Metallk. 49, 375(1958) July. (In German)

The constitution diagram of the lead-indium system is presented according to recent measurements. (auth)

14002

THE MEASUREMENT OF THE SPECIFIC HEAT OF METALS AT HIGH TEMPERATURES. Friedrich Krauss (Universität, Cologne). Z. Metallk. 49, 386-92(1958) July. (In German)

Methods are reviewed for measuring specific heats of metals at high temperatures, and a specific one used by the author is described. The specific heat of chromium was determined up to 1300°C by this technique. Appendices 1 and 2 list unpublished measurements of the specific heat of iron up to 1440°C as well as measurements on chromium up to 1400°C. (auth)

14003

MAGNETIC SUSCEPTIBILITY OF ALKALI ELEMENTS. PART I. SODIUM AND POTASSIUM. K. Venkateswarlu and S. Sriraman (Annamalai Univ., Annamalainagar, South India). Z. Naturforsch. 13a, 451-5(1958) June.

A vacuum Curie balance was specially designed for the study of magnetic susceptibilities at higher temperatures. With this apparatus the magnetic study of sodium and potassium was made at different temperatures ranging from 32 to 250°C. Special attention has been paid to the preparation of the specimen. Corrections for all possible errors have been made. The results point out that the susceptibilities of the metals increase with temperature both below and above their melting points. The temperature coefficients of the susceptibility of valence electrons of the two metals are in general agreement with Stoner's theory. (auth)

14004

MAGNETIC SUSCEPTIBILITY OF ALKALI ELEMENTS. PART II. LIQUID ALLOYS OF SODIUM AND POTASSIUM. K. Venkateswarlu and S. Sriraman (Annamalai Univ., Annamalainagar, South India). Z. Naturforsch. 13a, 455-8(1958) June.

Alloys of sodium and potassium were prepared in vacuum in a specially blown pyrex glass apparatus. Several bulbs containing these alloys of different compositions have been studied at temperatures ranging from 30 to 250°C. The compositions of these alloys have been determined by gravimetric method. The results show that for the alloys of all compositions the additivity law is obeyed both at room temperature and at higher temperatures. No evidence for the formation of the compound Na_2K could be detected from the magnetic study. (auth)

14005

THE VISCOSITY AND ELECTRICAL RESISTANCE OF BINARY LIQUID ALLOYS OF THE SYSTEM CADMIUM–COPPER. D. K. Belaschenko (Stalin Moscow Inst. of Steel). Zhur. Fiz. Khim. 32, 823-30(1958) Apr. (In Russian)

The kinematic viscosity and specific electrical resistance of liquid alloys of the system cadmium–copper were measured over the concentration range 0 to 55 at.% copper. The presence of maxima was revealed in the activation energies of viscous flow and in the electrical conductivities in the region 35 to 45% Cu, due apparently to the preservation in the liquid after melting of the near order characteristic of γ brass. (tr-auth)

14006

INVESTIGATIONS OF THE PHASE DIAGRAM, STRUCTURE, AND PHASE HOMOGENEITY LIMITS OF CARBON–VANADIUM–OXYGEN SYSTEM. III. THE X RAY DIFFRACTION STUDIES OF V–C–O. M. A. Gurevich and B. F. Ormont. Zhur. Neorg. Khim. 3, 403-12(1958) Feb. (In Russian)

A tentative phase diagram was plotted, and the mechanism of formation of oxycarbides and vanadium carbides from vanadium oxide was determined. (R.V.J.)

14007

EQUILIBRIUM IN THE TERNARY SYSTEM Ti–Al–Fe. I. I. Kornilov, E. N. Pylaeva, and M. A. Volkova. Zhur. Neorg. Khim. 3, 1391-7(1958) June. (In Russian)

Constitution diagrams were plotted for the Al–Fe–Ti alloy. The microstructure and hardness of the alloy were studied, and thermal and x-ray phase analysis was made. (R.V.J.)

14008

DIAGRAM OF HALL-EFFECT IN MOLYBDENUM–TUNGSTEN ALLOY. N. V. Grum-Grzhimailo and D. I. Prokof'ev. Zhur. Neorg. Khim. 3, 1470-1(1958) June. (In Russian)

The dependence of the Hall effect changes on the content in the binary molybdenum–tungsten alloy indicates the formation of a single equiatomic chemical compound in the solid solutions. (R.V.J.)

PHYSICS

Refer also to abstracts 14440, 14441, 14444, 14449, and 14465.

14009 AECU-3784

Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.

PROGRESS REPORT NO. XXIII. June 1958. 62p. Contracts Nonr-1841(10); AF30(635)-2872; and AT(30-1)-1937. $10.80(ph OTS); $3.90(mf OTS).

Progress is briefly reported on studies in dielectric spectroscopy, magnetic resonance, high-field-strength research, ferroelectrics and ferromagnetics, semiconductors, single crystals, and ceramics. (T.R.H.)

14010 AECU-3794

Washington Univ., St. Louis.

THE EFFECT OF TEMPERATURE ON HIGH-VACUUM ELECTRICAL CONDUCTION (thesis). Edmund K. Storms. Aug. 1958. [Project No. 5. Contract AT(11-1)-85]. 71p. $12.30(ph OTS); $4.50(mf OTS).

The role positive-ion evaporation plays in the voltage-controlling process in a well baked-out system was studied. It was found that the emission rate decreased as the system temperature was increased, and three ion peaks of mass 170, 18, and 1 were found in abundance. Further studies revealed a marked change in the electrical conductivity of the quartz supporting rod. Most of the ions at low temperatures and under very clean conditions are thought to be emitted from the surface by a process similar to sputtering. A continuous source of positive ions results from the bombardment by electrons and negative ions pulled from the rod during charging. No positive ions were found to result from beta radiation, and the anode surface is nonuniform with

respect to positive ion emission. Smaller anodes produce higher voltages, and under clean conditions this appears to be a fruitful field of research. (J.R.D.)

14011 AERE-I/R-1063(Rev.)

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

AN ISOTOPE HANDLING CALCULATOR (MK. 2). R. West. June 1958. 7p. $0.32(BIS).

A calculator is described which at a single setting inter-relates the source strength, gamma dose rate, distance from source, and screening by lead. Direct reading values are given for the isotopes Na^{24}, Co^{60}, Ra or Rn, Ta^{182}, Ir^{192}, Au^{198}, I^{131}. The Mk. II calculator differs from the original only in the revised calibration of Ir^{192} and revised safe dose rates recommended by the International Commission on Radiological Protection. The calculators are obtainable from the Isotope Information Office, Harwell, England. (auth)

14012 AFOSR-TN-58-383
AFOSR-TN-58-384

California. Univ., Berkeley.

ON THE DEVELOPMENT OF GASEOUS DETONATION. I. APPRAISAL OF THE PROBLEM. II. ANALYSIS OF WAVE INTERACTION PHENOMENA. Technical Notes DR 1 and DR 2. A. K. Oppenheim and R. A. Stern. (Pt. I, June 1958. 86p. and Pt. II, July 1958. 50p.) IER Project No. 96895. Contract AF49(638)-166.

Appendix of Pt. I consists of translation by Paul A. Urtiew, of selected sections from "Theory of Detonation," by Ya. B. Zeldovich and A. S. Kompaneets. Gosudarstvennoe Isdatel'stvo Tekhnika-Teoreticheskoi Literatury, Moscow, 1955.

These reports (further identified as AD-154290 and AD-154291, respectively) were issued separately, but are cataloged as a unit.

Current views about the phenomena associated with transition from deflagration to detonation are described. The history of the problem is traced from the "discoverers" of the detonative mode of combustion. Salient phenomena associated with transition from deflagration to detonation are the interactions between the flame and the shock fronts generated during the process. The scant records available in the literature on shock and flame propagation during the development of detonation are used as basis for the dynamic analysis of wave phenomena occurring during the process. It is demonstrated how, by this means, the observed wave interaction phenomena can be rationalized over the whole space-time domain of the process, and, in particular, how the thermodynamic state and the wave velocity in the régime into which the flame propagates can be determined with sufficient accuracy to deduce specific information on the reaction kinetics of a combustion front accelerating to detonation. (auth)

14013 AFOSR-TN-58-503

Miami. Univ., Coral Gables, Fla.

ELECTRON ENERGY BANDS IN SODIUM. Joseph Callaway. June 1958. 14p. Contract AF 49(638)-62. (AD-158314).

The potential energy of a valence electron in sodium is represented by the function $V(r) = -2/r + Ae^{-\beta r}/r$. The second term, which is repulsive in character, represents the effect of the core electrons. Values for A and β were determined from spectroscopic data. Energy levels of predominantly S and p symmetry were determined at four points of the Brillouin Zone. (auth)

14014 ISC-975

Ames Lab., Ames, Iowa.

SEMI-ANNUAL SUMMARY RESEARCH REPORT IN PHYSICS FOR JULY THROUGH DECEMBER 1957. 60p. Contract W-7405-eng-82. $1.50(OTS).

The experimental deviations from allowed shape in beta-decay spectrum of P^{32} are being investigated. The quantization process for a recently proposed theory of particles of arbitrary spin and zero mass was carried out. The positions and half-widths of the energy levels of atomic hydrogen in an external electric field were calculated. The decay of Yb^{169} by electron capture to Tm^{169} was investigated. In the electron capture decay of Ba^{133}, additional gamma rays of energies 382, 276, 220, 162, and 81 kev were observed. From gamma-gamma coincidence studies the levels in Cs^{133} were placed at 81, 162, 382, and 438 kev. The decay of Tb^{156} was investigated, and it was concluded that the decay of Tb^{156} proceeds by means of K capture to Gd^{156}. A pulse heating has been developed for measuring the specific heats of metals with an error of less than 2% from 20 to 1000°C, and the method has been successfully applied to high-purity iron. An elliptical technique of recording thermal diffusivity data was developed. The thermoelectric power of Mg_2Si was measured in the temperature range 300 to 1000°K. Large single crystals of WO_3 were prepared, and some of the electrical and optical properties determined. The latent heat of sublimation of very pure europium was measured at 730°K. The number of ionized rare earth atoms from a tungsten filament was studied in the mass spectrometer as a function of incident flux and filament temperature. The phase transitions of cerium at room temperature and 7000 atmospheres pressure were investigated. A survey is given of the determination of pressure effects on the superconducting transition temperatures of tin, tantalum, thallium, indium, and mercury. The pure nuclear quadrupole resonance spectra of Br^{79} and Br^{81} in solid $TiBr_4$ were detected and measured. A recording radiofrequency spectrometer was constructed for the study of conduction electron spin resonance in metals and alloys in very weak magnetic fields. (For preceding period see ISC-901.) (W.D.M.)

14015 NP-6840

Massachusetts Inst. of Tech., Cambridge.
Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 29. July 15, 1958. 41p. Contract Nonr-1841(34).

Matrix elements for Compton scattering of x rays from non-spherical charge distributions are presented. X-ray atomic scattering factors for non-spherical charge distributions are given for N^-, Ne, Tl^+, Tl^{3+}, Ti^+, V^{2+}, Mn^+, and Fe. The spin-orbit interaction and the electronic structure for the O_2^+ molecule are discussed. Values are given for energy bands in wurtzite structures. In attempting to calculate the expectation value of the Hamiltonian of a KCl crystal having one 3p hole with a wave function that contains a correlation between the motion of the hole and of the crystal ions, the dependence of the crystal wave function W on the nuclear coordinates X was clarified. Progress on electronic wave functions for polyatomic molecules, multi-center integral programs for IBM-704, and atomic calculations is summarized briefly. (For preceding period see NP-6709.) (M.H.R.)

14016 NP-6847

Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.

SOLUTION OF A DIFFRACTION PROBLEM. Herch

Moysés Nussenzveig. 1957. 223p. (Notas de Fisica Vol. III(Suppl.)).

An attempt is made to find a simple method for dealing with a typical diffraction problem, which would throw some light on the following questions: the reasons for the success of Kirchhoff's approximation, the error and limits of validity of this approximation, the possibility that Kirchhoff's approximation is the first step of an accurate solution by a method of successive approximations, and finding a physical picture of the phenomena which occur both in the short and in the long wavelength regions, in order to understand the connection between them. The problem of the "double wedge" is investigated, which may be thought of as semi-infinite parallel-plate waveguide with an infinite plane flange at the mouth, forming a pair of perfectly conducting, infinite, rectangular wedges. The following topics are covered: the formation of the problem, classical diffraction theory in k-space, the coefficients of the system of linear equations, the single wedge problem, the independent wedges approximation, the iteration method, and the narrow double wedge. Appendices are included on the following: the integrals $E_{\pm n}(K)$ for the wide double wedge, the integrals S_n and C_n for the narrow double wedge, the evaluation of some definite integrals, the (R)-identities, the reflection coefficient, the asympototic expansion of the Ξ function, the solution of systems (S_6) and (S_4) and the evaluation of $(K'^2)_{m,o}$. (M.H.R.)

14017 WADC-TR-57-660

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

ELECTRICAL CONDUCTIVITY STUDIES OF METALLIC FILMS. Period covered: November 15, 1956 to November 15, 1957. Richard B. Belser and Walter H. Hicklin. Dec. 1957. 135p. Project No. 7-(8-7080). Contract AF33(616)-3870. (AD-155573).

The temperature coefficients of resistance (TCR) of films of sputtered Au, Ir, Mo, Ni, Pd, Pt, Rh, and Ta, of evaporated Zr, Ti, and Cr, and of the alloy films Pt–Au, Pt–Ir, and Pt–Ni were measured in vacuo over the temperature range 25 to 600°C; the film thickness range was 100 to 3000 A. The TCR values of films of the substantially pure metals were approximately ⅔ those of the respective bulk metals whether the films were deposited on glass, Vycor, or Stupalith substrates. The departure of the conditions of growth of the film from those usual for the bulk metal, i.e., rapid cooling effects and impurities present, contributed dislocations and imperfections which reduced the TCR of the film. The TCR values of alloy films were low, 0.0004 for Au–Pt, and resistivities were 3 to 4 times that of either constituent. The TCR values of sputtered films of Mo and Ta and of evaporated Zr and Ti were 0.0001 or less. Oxide inclusions in these films appeared to contribute a negative TCR, effectively neutralizing that of the metal. Only films of gold and platinum were corrosion resistant near 600°C. Protective coats of evaporated SiO provided partial protection for the others. Powers up to 15 watts were dissipated by refractory metal films only 1/32 in. by 1/2 in. in area and about 750 A thick. These high values contrasted with less than 1/4 watt for a gold film of similar dimensions. If protection from oxidation can be provided films of the refractory metals, they should prove to be highly valuable for use in electronic resistors or other components. (auth)

14018 WAPD-198

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

STUDY OF THE FORCE-DEFLECTION CHARACTERISTICS OF A BELLEVILLE SPRING. J. E. Meyer. Apr. 1958. 25p. Contract AT-11-1-GEN-14. $0.75 (OTS).

Calculated predictions of Belleville spring behavior based on simple theory can be misleading. A sample problem is developed in which this is the case. Sources of error are pointed out, and the importance of considering in detail the method of load application is stressed. (auth)

14019 AEC-tr-3227

AERODYNAMICS OF SUPERSONIC FLIGHT (Aerodinamika Sverkhzvukovogo Poleta). V. Pyshnov. Translated from Sovet. Aviatsiya, No. 107 (2665) (1957) May 8. 10p.

Answers to some questions on basic features of supersonic flight, aircraft configurations and performance, and the ballistic ceiling are given. (W.D.M.)

14020 NP-tr-111

ON THE THEORY OF SKIN-EFFECT IN A CONSTANT MAGNETIC FIELD. M. Ya. Azbel'. Translated from Doklady Akad. Nauk S.S.S.R. 100, 437-40(1955). 7p. Available from Morris D. Friedman, West Concord, Mass.

The surface impedance is found in a constant magnetic field parallel to the surface of the metal. The reflection of the electrons from the surface is considered to be diffuse. (M.H.R.)

14021 NP-tr-112

MEASUREMENT OF THE FIELD OF THE MAGNETS OF ACCELERATORS WITH STRONG FOCUSSING. N. H. Grekov, A. P. Ryabov, and L. L. Gol'din. Translated by P. Collins (U.K.A.E.A., Atomic Energy Research Establishment) from Pribory i Tekh. Eksper. 2, 29-37(1956). 15p.

A method of measurement of a time-varying magnetic field with a gradient which is nearly constant (the field of magnets of accelerators with strong focussing) is described. Special coils which allowed the gradient of the magnetic field at the center of the coil to be measured directly and an integrator with a stabilized zero were used. The results were read off by use of an oscillograph. The method allowed the configuration of the magnetic field to be measured to an accuracy of 0.02%. The high sensitivity of the apparatus made possible the study of a number of weak effects, for example, measurement of the configuration of the field when thin sheets (0.2 mm) of non-magnetic stainless steel (the walls of the {chamber}) are introduced into the magnet gap. (auth)

14022 SCL-T-192

THE POLYSTYRENE CONDENSERS (CAPACITORS). (Les Condensateurs au Polystyrene). R. Leprince-Ringuet and J. Leautier. Translated by Marcel I. Weinreich (Sandia Corp.) from Onde électrique 37, 1083-8(1957). 12p.

Paper strips of 5 to 6 μ thickness have good dielectric coefficients of the order of magnitude of 6; however, the porousness of the paper must be remedied by impregnation, which reduces the dielectric constant from 6 to 4 or 5. Polystyrene, which has exceptional electrical characteristics, was used to improve the performance of the paper condensers. A condenser with polystyrene as the dielectric may be charged and preserved for months before its voltage shows any appreciable diminution. (A.C.)

14023

ON THE THEORY OF THE SUPERCONDUCTANCE OF METALS. S. V. Vonsovskii and M. S. Svirskii (Inst. of

Physics of Metals, Urals Branch of Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 120, 269-72(1958) May 11. (In Russian)

A multielectron model of a metal was used in studies of superconductivity in relation to the metal structure. (R.V.J.)

14024

ELECTRON SCATTERING IMAGE CONTRAST IN ELECTRON MICROSCOPY. P. Sadhukhan (Inst. of Nuclear Physics, Calcutta). Indian J. Phys. 32, 249-58(1958) May.

The elastic scattering cross sections for a 60 kv electron beam have been calculated for several different elements from the equations of Molière and Lenz. The variation of the scattering cross section with the aperture angle and with the beam voltage has been considered. The inelastic scattering cross sections for the same elements have also been estimated from Lenz equations. The values of different cross sections have been compared, and their relative importance in the production of contrast in an electron microscopic image has been estimated. (auth)

14025

THE STRUCTURE OF GAS-ADSORBENT CARBONS. W. F. Wolff (Standard Oil Co., Whiting, Ind.). J. Phys. Chem. 62, 829-33(1958) July.

Irregularly shaped and layer-type pore structures have both been proposed for gas-adsorbent carbons. In an attempt to distinguish between these structures, the penetration by liquids with different molecular shapes into the pore systems of these carbons was studied. Conventional nitrogen-adsorption and analytical methods was applied to the calculation of structural dimensions. The evidence favors a layer-type structure, with a micropore system consisting of molecular-size fissures between relatively large graphitic planes. (auth)

14026

SURFACE TENSION AT ELEVATED TEMPERATURES. IV. SURFACE TENSION OF Fe–Se AND Fe–Te ALLOYS. W. D. Kingery (Massachusetts Inst. of Tech., Cambridge). J. Phys. Chem. 62, 878-9(1958) July.

Experimental data are given which show the effect of surface active agents, Se and Te, on the surface tension of liquid iron. The sessile drop method was used. Both selenium and tellurium decreased the surface tension, however, the effect of tellurium is much less marked. (D.E.B.)

14027

HIGH ENERGY NUCLEAR PHYSICS. G. H. Stafford. Nature 182, 356-8(1958) Aug. 9.

Proceedings are summarized of the International Conference on High-Energy Nuclear Physics held at Geneva, 1958. (C.H.)

14028

SUPPRESSION EFFECT OF THE IONIZATION PRODUCED BY ELECTRON-POSITRON PAIRS OF EXTREMELY HIGH ENERGY. Junji Iwadare (Univ. of Bristol, Eng.). Phil. Mag. (8) 3, 680-91(1958) July.

The ionization produced by 27 electron-positron pairs with energies between 80 and 2000 Bev, recorded in stacks of emulsion, has been studied. The energies were estimated from the development of the soft cascades in an auxiliary experiment. Suppression of the ionization near the origin of the pairs was observed, and the measured effect found to be in satisfactory agreement with theoretical predictions. The observations allow an independent estimate of the energy of the individual pair from the initial ionization, and for pairs with energy ~300 Bev most of the values thus obtained were in good accord with those from other methods. There is a correlation between the suppression effect and the disparity in energy of the two particles of a pair. This suggests that ionization measurements give information similar to that provided by studies of the relative scattering of the two components of a pair. (auth)

14029

ELECTRICAL RESISTIVITY OF THIN FILMS OF POTASSIUM AT 100°K. D. G. Worden and G. C. Danielson (Iowa State Coll., Ames, Iowa). Phys. and Chem. Solids 6, 89-95(1958) July.

The electrical resistivity of thin potassium films at 100°K has been measured as a function of thickness in the range 148 to 1600 A. The experimental results are in excellent agreement with Fuchs's theoretical predictions in the range 500 to 1600 A and show that the scattering of the electrons at the film surfaces is completely diffuse. Comparison of experimental and theoretical curves gives a bulk resistivity parameter of 1.85 $\mu\Omega$-cm, a mean free path of 1180 A, and an electron to atomic density ratio of 1.0. The films were deposited on a Pyrex substrate from a beam of potassium vapor in a vacuum chamber which had a pressure less than 5×10^{-8} mm Hg. The film thickness, in each case, was computed from a known beam intensity, exposure time, and film density. A surface ionization detector was used to calibrate the beam intensity (J_1) as a function of effusion oven temperature (T_0). The linear plot of log ($J_1 T_0^{1/2}$) versus T_0^{-1} gave a heat of sublimation for potassium at 450°K of 21.1 kcal/mole, in good agreement with Brewer's value of 21.4 kcal/mole within experimental error. (auth)

14030

THE COMPOSITION, RESISTIVITY, AND THERMOELECTRIC POWER OF CERIUM OXIDES BELOW 500°C. A. W. Czanderna and J. M. Honig (Purdue Univ., Lafayette, Ind.). Phys. and Chem. Solids 6, 96-7(1958) July.

The results of a study on the stoichiometry, resistivity, and thermoelectric power of cerium oxide in high vacuum and in oxygen for the temperature range 45 to 485°C are presented. By heating the oxide, considerable quantities of gases were evolved but little change in the resistivity of the sample was detected up to 160°C. An incipient decomposition occurred in the temperature range 160 to 485°C. The sample composition remained stable in high vacuum in the region 485 to 600°C. (J.E.D.)

14031

SPHERICAL BUBBLE GROWTH. G. Birkhoff, R. S. Margulies, and W. A. Horning (Ramo-Wooldridge Corp., Los Angeles). Phys. Fluids 1, 201-4(1958) May–June.

Plesset and Zwick [J. Appl. Phys. 23, 95-98(1952); 25, 493-500(1954); J. Math. Phys. 33, 308-330(1955)] have calculated the rate of growth of vapor bubbles in slightly superheated steam under constant external pressure. Their calculation assumes that the temperature drop is localized in a thin "boundary layer" near the bubble wall; the predicted bubble radius R(t) is asymptotically proportional to $t^{1/2}$ when R is large enough for surface tension to be negligible. An analysis of this asymptotic phase is given, which avoids the above "boundary layer" assumption, and contains that part of the analysis of Plesset and Zwick dealing with this phase as a limiting case. The analysis is shown to be (approximately) applicable also to gas bubbles in supersaturated liquids. (auth)

14032

SHOCK-FRONT-THICKNESS MEASUREMENTS BY AN ELECTRON BEAM TECHNIQUE. H. N. Ballard and Douglas Venable (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids 1, 225-9(1958) May–June.

An electron beam densitometer is described for investigating the structure of a shock front in low-density gases. The parameters measured by this technique are directly related to those parameters used in the accepted definition of shock front thickness. Hence the interpretation of the data is direct; no model of the shock front structure must be assumed and no theoretical treatment of nonequilibrium flow conditions is needed. An approximate method of data reduction is used for treating preliminary results. The measured value of the thickness of a Mach 4 shock in argon is about three mean free paths, measured in terms of the undisturbed gas. This technique provides a new tool for investigating relaxation phenomena behind shock waves. (auth)

14033

STRUCTURE OF A CENTERED RAREFACTION WAVE IN A RELAXING GAS. William W. Wood and F. R. Parker (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids 1, 230-41(1958) May–June.

The structure of a centered rarefaction wave in a relaxing ideal gas is studied theoretically, both analytically and numerically, with neglect of the Navier-Stokes terms (viscosity, etc.) in the hydrodynamic equations. The role of the "frozen" sound speed is clarified, in that it is shown that there is a transition from "frozen" flow at short times to equilibrium flow at long times. (auth)

14034

RELAXATION TIME FOR REACTIONS BEHIND SHOCK WAVES AND SHOCK WAVE PROFILES. Russell E. Duff (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids 1, 242-5(1958) May–June.

An expression is developed for the relaxation time for the approach to equilibrium for the dissociation of a diatomic gas behind a shock wave. This expression shows the importance of the variation of temperature behind a shock on the rate of approach to equilibrium. Numerical calculations of the shock wave profile in O_2 for two different dissociation mechanisms show that the relaxation time analysis is only appropriate for the description of the dissociation within a few percent of equilibrium. The calculations also show that ozone is not an effective intermediate for the shock dissociation of O_2 and that it is impossible to define a relaxation time for the over-all dissociation process which is inversely proportional to pressure or density. (auth)

14035

MAGNETIC STRUCTURES OF MnO, FeO, CoO, AND NiO. W. L. Roth (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 110, 1333-41(1958) June 15.

The antiferromagnetic arrangement of moments in MnO, FeO, CoO, and NiO have been investigated by powder neutron diffraction. The results for the four oxides are consistent with a structure in which the magnetic moments are arrayed in ferromagnetic sheets parallel to (111) planes, and the direction of magnetization in neighboring planes is antiparallel. The observation of diffuse neutron scattering limits the precision with which the magnetization direction can be specified. If the diffuse intensity is included with the Bragg scattering, the direction of magnetization in MnO, and NiO lies within the (111) plane; for CoO, the preferred direction is $[\bar{1}17]$, intermediate to the (111) plane and the tetragonal axis. The magnetic axis in FeO is perpendicular to the ferromagnetic sheet. (auth)

14036

CORRELATION OF λ-POINTS AND PHASE SEPARATION TEMPERATURES IN ^3He–^4He SOLUTIONS. Charles E. Hecht (Universiteit van Amsterdam, Netherlands). Physica 24, 584-8(1958) July.

It is predicted that above a certain critical value for He^3 mole fraction, X_3, in He^3–He^4 solutions no superfluid properties exist and that thus the T_λ vs. X_3 curve should coincide with a plot of phase separation temperature vs. X_3 for large X_3. (auth)

14037

RELATION BETWEEN DISACCOMMODATION AND MAGNETIC PROPERTIES OF MANGANESE-FERROUS FERRITE. U. Enz (Philips Research Labs., Eindhoven, Netherlands). Physica 24, 609-24(1958) July.

Initial permeability, crystalline anisotropy, and magnetostriction have been measured on a single crystal of manganese-ferrous ferrite. The initial permeability shows a high disaccommodation, i.e., a decrease with time. This decrease can be as high as 95% of the value immediately after demagnetization. Disaccommodation is a time-dependent blocking of domain walls, the cause of which is supposed to be a transition of electrons between different ions. The blocked walls cause constricted minor hyseresis loops which indeed have been found. Manganese-ferrous ferrites have in general an extra peak of the permeability as a function of temperature not understood up till now. It is shown that this is an effect of disaccommodation. (auth)

14038

DEVELOPMENT OF AN OCCLUDED-GAS ION SOURCE. Kenneth W. Ehlers, James D. Gow, Lawrence Ruby, and John M. Wilcox (Univ. of California, Berkeley). Rev. Sci. Instr. 29, 614-19(1958) July.

An ion source for pulsed operation has been developed which is based on producing a spark discharge between electrodes of a transition metal in which ordinary hydrogen or deuterium has been occluded. The beam consists principally of ions of hydrogen and of the electrode material. No neutral gas is evolved between pulses. High beam-current densities have been obtained, both with axial and with radial extraction. Various methods have been devised for filtering out the heavy-mass components of the beam. (auth)

14039

DEPOSITION OF ATOMIC BEAMS. Sol Wexler (Argonne National Lab., Lemont, Ill.). Revs. Modern Phys. 30, 402-9(1958) Apr.

The efficiency of sticking is known to be dependent on composition and density of the beam and the nature and temperature of the surface. Knowledge in this field for the benefit of workers in molecular beams is reviewed. Particular emphasis is placed on condensation or sticking coefficients, critical temperatures for condensation, and binding energies of atoms on surfaces. Two theories of deposition of atomic beams are reviewed. (W.D.M.)

14040

EQUILIBRIUM DISTRIBUTION OF CHARGES IN A BEAM OF IONS OF LIGHT ELEMENTS. V. S. Nikolaev, I. S. Dmitriev, L. N. Fateeva, and Ia. A. Teplova (Moscow State Univ.). Soviet Phys. JETP 6, 1019-25(1958) June.

The equilibrium distribution of ionic charges of light elements with atomic numbers Z between 5 and 10 was

studied after passage of the ions through hydrogen, air, argon, and celluloid film with velocities ranging from 3.5 to 8 to 11 × 10^8 cm/sec. The mean ionic charge $\bar{I}$ was found to be from 10 to 30% larger after passage through the film than after passage through air. The values of $\bar{I}$ in gases were found to differ by 10 to 20%. The distribution of the ions in a beam with respect to $\bar{I}$ is approximately Gaussian. (auth)

14041

POLARIZATION OF A BEAM OF MOLECULES IN AN ALTERNATING FIELD WITH VARIABLE AMPLITUDE AND PHASE. G. P. Liubimov and R. V. Khokhlov (Moscow State Univ.). Soviet Phys. JETP 6, 1074-9(1958) June.

Equations are derived which describe the behavior of a beam of molecules under the action of an alternating field with variable amplitude and phase; these equations are solved for various cases. An exact solution is obtained for the case in which the frequency of the applied field, the amplitude of which is varying, is the same as the frequency of the molecular transition. Approximate solutions are obtained for the cases in which the amplitude and frequency of the field vary slowly or rapidly during the time of flight through the cavity. (auth)

14042

TABULATED MASS DIFFERENCES. V. A. Kravtsov (Leningrad Polytechnic Inst.). Soviet Phys. JETP 6, 1164-5(1958) June.

The atomic masses of Mn^{55}, Mn^{56}, and Fe^{55} were recalculated with results in better agreement with experimental data. The following weighted mean values were found: Mn^{55} = 54.955512 ± 8, Mn^{56} = 55.956700 ± 8, and Fe^{55} = 54.955761 ± 8. (J.S.R.)

14043

CONCERNING THE STABILITY OF SHOCK WAVES. V. M. Kontorovich (Inst. of Radiophysics and Electronics, Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 6, 1179-80(1958) June.

In the study of the stability of normal discontinuities in an arbitrary medium with respect to perturbation of a wave type, D'iakov (Zhur. Eksptl'. i Teoret. Fiz. 27, 288(1954)) found a region of absolute instability when the perturbation from the shock grew with time, a region of stability when this perturbation is damped, and a peculiar region of "spontaneous sound emission by the discontinuity" in which the perturbation has the form of an undamped travelling wave. This last region is defined in the present article. (J.S.R.)

14044

REFLECTION AND REFRACTION OF SOUND BY A SHOCK WAVE. V. M. Kontorovich (Inst. of Radiophysics and Electronics, Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 6, 1180-1(1958) June.

The reflection and refraction of sound by a shock wave in an arbitrary medium is considered, and the perturbation of the surface of the shock wave is taken into account. (J.S.R.)

14045

PROBABILITIES OF OPTICAL TRANSITIONS FOR ATOMS AND DIATOMIC MOLECULES. V. N. Kolesnikov and L. V. Leskov. Uspekhi Fiz. Nauk 65, 3-38 (1958) May. (In Russian)

A comprehensive bibliography is presented on the possibilities of optical transitions in atoms and molecules with a special emphasis on the methods of calculation for probabilities of electron-oscillating transitions in diatomic molecules. 370 references. (R.V.J.)

Aerosols

Refer to abstracts 13916 and 14264.

Astrophysics

14046 NP-6887

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

ON THE ISOTROPIC MODELS OF THE UNIVERSE. Ia. A. Smorodinskii. 1957. 13p.

How the present experimental data on red shift are described by the isotropic homogeneous model are analyzed. (W.D.M.)

Cosmic Radiation

Refer also to abstract 13646.

14047

THE POSSIBILITY OF PREDICTION OF SOLAR PHENOMENA AND THEIR REPERCUSSIONS ON THE EARTH BY STUDYING COSMIC RAY INTENSITY. Jean-Pierre Legrand. Compt. rend. 247, 70-3(1958) July 7. (In French)

Several cosmic radiation storms were observed during the period from April 12, 1957, to March 31, 1958, a time when the intensity of cosmic radiation was being constantly monitored. The cosmic storms were preceded by a decrease in the level of cosmic intensity of the order of 1 to 3% with respect to the normal level. This decrease, which was called the "beginning of the pre-decline," preceded from 24 to 48 hours the chromospheric eruptions which are followed by geomagnetic and ionospheric disturbances. It appears possible that this "beginning of the pre-decline" could be used to predict solar phenomena and their repercussions on the earth. (J.S.R.)

14048

COSMIC-RAY MODULATION BY SOLAR WIND. E. N. Parker (Univ. of Chicago). Phys. Rev. 110, 1445-9 (1958) June 15.

It is shown that the hydrodynamic outflow of gas from the sun observed by Biermann results in a reduction of the cosmic-ray intensity in the inner solar system during the years of solar activity. The computed cosmic-ray energy spectrum so closely resembles the observed spectrum at earth that we suggest the outflow of gas to be the explanation for the 11-year variation of the cosmic-ray intensity. It is also suggested that perhaps the Forbush-type decrease, which is a local geocentric phenomenon, is the result of disordering of the outer geomagnetic field by the outflowing gas from the sun. (auth)

14049

TRANSITION EFFECT OF STARS IN A LEAD ABSORBER. T. V. Varsimashvili and N. I. Kostanashvili (Phys. Inst., Georgian S.S.R.). Soviet Phys. JETP 6, 1183-4(1958) June.

The results of a control experiment undertaken in order to observe by means of photographic emulsions the transition effect for stars in lead absorbers are presented. The measurements were made at 3100 m above sea level. The maximum of the transition effect was 30%. Three-fold scanning of the same volume of emulsion was used, and a sharply pronounced maximum was observed. (J.S.R.)

Crystallography and Crystal Structure

14050 AFOSR-TR-58-98

Miami. Univ., Coral Gables, Fla.
STUDIES OF ELECTRON ENERGY BANDS. Final Technical Report. Joseph Callaway. June 1958. 15p. Contract AF49(638)-62. (AD-162172).

A summary of the studies of electron energy bands is presented. The contribution of relativistic effects to the cohesive energies of the alkali metals was investigated, and a numerical estimate was made for cesium. The general form of energy bands is discussed, and the effective mass of electrons in gallium arsenide is predicted. The energy bands in sodium were calculated, and a Fourier analysis of the crystal potential in silicon and lithium is presented. The existence of electronic eigenstates in a finite one-dimensional lattice localized near the edges was considered. (J.R.D.)

14051 NYO-7303

New York Univ., New York. Coll. of Engineering.
ORIGIN OF RECRYSTALLIZATION NUCLEI. Final Technical Report. L. P. Stone and J. P. Nielsen. Jan. 31, 1958. 15p. Contract AT(30-1)-1754. $3.30(ph OTS); $2.40(mf OTS).

A specimen of high-purity beta brass was prepared for measurements of the distribution of spatial grain volumes, intercept areas, and intercept lengths. (W.D.M.)

14052 AEC-tr-3336

ON THE INTERACTION OF TWINS IN Bi, Zn AND Sb. V. I. Startsev and V. M. Kosevich. Translated by Steven J. Rothman (Argonne National Lab.) from Doklady Akad. Nauk S.S.S.R. 104, 413(1955). 4p.

An investigation of the interaction of twins belonging to different systems as they cross each other is reported. The investigation was conducted at room temperature on single crystals of Bi, Zn, and Sb under different conditions of stress (bending, concentrated forces, etc.). It was shown that the character of the interaction is determined first by the properties of the metal, and to a lesser degree by the method of deformation. (A.C.)

14053

CRYSTALLOGRAPHIC CALCULATIONS ON THE SILLIAC ELECTRONIC DIGITAL COMPUTER. II. STRUCTURE FACTORS. H. C. Freeman (Univ. of Sydney). Australian J. Chem. 2, 99-103(1958) May.

Two programs for crystal structure factor calculations on the Silliac computer are briefly described, with special reference to the problem of coding such computations efficiently for a computer of high-speed but limited storage capacity. (auth)

14054

ELECTRON PROJECTOR OBSERVATION OF ZIRCONIUM $\alpha \rightleftharpoons \beta$ TRANSFORMATIONS. A. P. Komar and V. N. Shrednik. Fiz. Metal. i Metalloved. 5, 452-64 (1958). (In Russian)

Phase transitions $\alpha \rightleftharpoons \beta$ for zirconium monocrystals of one micron order were studied. Enlargements in an electron microscope up to 100,000 times permitted visual observations of crystal transformations. Emission pictures were obtained for cubic (β zirconium) and hexagonal (α zirconium) symmetry. Dislocation signs observed in zirconium were related to the non-diffusion mechanism of transitions. (tr-auth)

14055

THE EFFECT OF HYDROSTATIC PRESSURE ON THE TENSILE DEFORMATION OF SINGLE CRYSTALS. Peter Haasen (Max-Planck-Institut für Metallforschung, Stuttgart) and Andrew W. Lawson, Jr. (Univ. of Chicago). Z. Metallk. 49, 280-91(1958) June. (In German)

The effect of 5000 atm pressure on the tensile stress-strain curve was investigated for single crystals of aluminum, copper, nickel, and α-brass as well as polycrystalline nickel. In all cases except nickel single crystals, the flow stress increases with pressure. The increase is larger than is expected from the change in the elastic moduli with pressure. Returning to deformation at 1 atm following a strain at 5000 atm the flow stress is still higher than normal. In pure metals the rise in flow stress under pressure is interpreted in terms of the work done against pressure to produce volume changes. The volume change due to plastic deformation is about 10^{-4}. The residual increase in flow stress at 1 atm after deformation under pressure shows that the crystal work hardens more strongly under pressure in favor of a decreased volume production. These results are interpreted in terms of dislocation theory. An investigation on zinc single crystals shows that the hydrostatic pressure has no effect on deformation twinning. Twins thus are produced by the action of shear stresses only. A nucleation of twins at micro-cracks seems to be unlikely in this case since pressure strongly suppresses fracture in these crystals, but not twinning. (auth)

Electrical Discharge

Refer also to abstracts 14448 and 14453.

14056 AERE-T/M-160

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE DIFFUSION OF MAGNETIC FIELDS IN A CYLINDRICAL CONDUCTOR. J. H. Adlam and R. J. Tayler. Apr. 1958. 23p. $0.63(BIS).

The conventional stabilized pinched discharge requires axial and azimuthal magnetic fields which are to a high degree separated. The finite electrical conductivity of the discharge causes these fields to diffuse into one another. A complete discussion of this process would be very complicated requiring consideration of anisotropic transport processes and dynamic behavior of the plasma. The simplest discussion states that significant field mixing occurs in an electromagnetic penetration time τ determined by the relevant electrical conductivity. The further result of this memorandum is to show, on very simple assumption, what fraction of τ is important in stability problems. It is shown that regarding the discharge as an incompressible fluid of uniform conductivity, sufficient field diffusion to lead to loss of stability can occur in times of the order of $10^{-3}\tau$. (auth)

14057 CERN-58-15

European Organization for Nuclear Research, Geneva.
NOTE ON A TWO-STRING MODEL USED TO EXAMINE THE EFFECTS OF CHARGE SEPARATION ON THE STABILITY OF A PLASMA CURRENT THREAD. A. Schoch. June 24, 1958. 9p.

An attempt is made to show that the stability of the two-string model as used by Budker is due to a simplifying assumption which might not be valid in reality, i.e., the neglect of the longitudinal momentum of the positive ions. It is concluded that the two-string model does not provide stability if one assumes zero total longitudinal momentum. (M.H.R.)

14058 TID-3072
Technical Information Service Extension, AEC.
CONTROLLED THERMONUCLEAR PROCESSES. A Selective Bibliography. Thomas W. Scott, comp. May 1958. 34p. $1.00(OTS).

A total of 126 annotated references to unclassified reports and journal articles is presented, covering research and development conducted in the United States in the field of controlled thermonuclear reactions. Author, subject, and report number indexes are included. (auth)

14059 UCRL-5153
California. Univ., Livermore. Radiation Lab.
THERMAL EQUILIBRIUM IN A JOULE-HEATED PLASMA. A. N. Kaufman and H. P. Furth. Feb. 26, 1958. 9p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

A convenient coördinate system is found for calculating certain equilibrium temperature distributions in one and two dimensions. The maximum temperature is shown to be expressible purely as a function of the applied voltage and magnetic field, independent of spatial dimensions. The one-dimensional temperature distribution is obtained as a function of potential and also as a function of the ordinary spatial coordinate. (auth)

14060 NP-tr-113
ON THE MOTION OF THE IONS AND THE PROFILE OF THE SPARK LINES IN THE POSITIVE COLUMN OF A DISCHARGE. II. RADIAL MOTION OF THE IONS IN A LOW PRESSURE DISCHARGE. Yu. M. Kagan and V. I. Perel. Translated by A. N. Dellis (U.K.A.E.A., Atomic Energy Research Establishment) from Optika i Spektroskopiya 4, (1958). 13p.

An approximate method is proposed for finding the radial part of the velocity distribution function in the positive column of a low pressure discharge. By means of this method, the dependences of the radial drift velocity of the ions and of the effective ion temperature upon the distance from the axis of the tube are found. An expression is found for the effective temperature, determined from the profile of the spark lines, when observed perpendicular to the axis of the tube. (auth)

14061 NP-tr-114
THE ELECTRON TEMPERATURE AND DEGREE OF IONISATION IN THE INITIAL STAGE OF A POWERFUL PULSED DISCHARGE. V. I. Kogan. Translated by J. B. Sykes (U.K.A.E.A., Atomic Energy Research Establishment) from Atomnaya Energ. 4, 178-80(1958). 9p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 7909.

14062 SCL-T-190
A NEW METHOD OF TEMPERATURE MEASUREMENT IN HIGH-TEMPERATURE ARC COLUMNS. PART I. (Eine neue Methode zur Temperaturmessung an hochtemperierten Bogensäulen. I. Teil.) Hans Bartels. Translated by M. I. Weinreich (Sandia Corp.) from Z. Physik 127, 243-73(1950). 38p.

The temperature in arc columns may be determined on lines with self-reversal. The temperature is ascertained from the ray (beam) densities of the maxima which flank the central reversal minimum. Since only such lines are relevant whose lower term lies noticeably above the fundamental state of the neutral atom, this method finds its proper area of application within temperature and pressure ranges where other spectroscopic methods fail because of the absorption in the source of light. In this area, the method has very broad possibilities of application because it is not limited by any special data. The theory of the method is, for the time being, developed only as far as its application to arc lines is concerned. (auth)

14063
THE POTENTIAL AND FIELD INTENSITY CURVE IN THE CATHODE FALL RANGE OF A GLOW DISCHARGE. Gunter Brederlow (Deutschen Akademie der Wissenschaften, Berlin). Ann. Physik 1, 359-76(1958). (In German)

The potential distribution was determined in the cathode fall region with a glowing cathode in normal and abnormal He, Ne, Ar, H_2, and N_2 discharges. The field intensity pattern on the axis of the discharge was determined by differentiation of the potential curve. The results of the measurement were compared with the mobility theory given by Warren and it was established that this theory described correctly the ratio between the glow discharge light and the cathode in the first half of the cathode fall region. In the immediate cathode vicinity, deviations appeared for which an explanation was sought. (tr-auth)

14064
PLASMA INVESTIGATIONS WITH AN ELECTRON RADIATION PROBE OF SMALL DIAMETER. M. von Ardenne, S. Schiller, and H. Westmeyer (Forschungsinstitut Manfred von Ardenne, Dresden). Exptl. Tech. Phys. 6, 49-62(1958). (In German)

The rather complex plasma of a plasmatron ion source with an artificially set-up cathode potential drop was investigated using an electron radiation probe of very small diameter. The 35-kv electron radiation of a precision electron oscillograph was used as the probe. By relative motion of the discharge in comparison with the electron probe, the plasma field strength was measured from the cathode fall region to the anode fall region. The observed deviations and deformations of the focus by the plasma oscillation field was discussed. A conformity between the degree of orientation of the plasma and the plasma field strength gradient was shown. (tr-auth)

14065
THE EFFECT OF A UNIFORM MAGNETIC FIELD ON ELECTRODELESS DISCHARGE IN A TUBE AND MEASUREMENT OF ELECTRONIC MOBILITY. II. OXYGEN, NITROGEN, CARBON DIOXIDE, AND HYDROGEN. S. N. Goswami (Calcutta Coll.). Indian J. Phys. 32, 241-8(1958) May.

Results of measurements of the percentage increase in the breakdown potential and of electronic mobility in a discharge tube filled with O_2, N_2, CO_2, and H_2 and excited with a 50-cycles alternating voltage under a uniform magnetic field are reported. Measurements are made at different pressures and under magnetic fields inclined at different angles with the electric field. (auth)

14066
MOVING STRIATIONS IN ARC DISCHARGE. Hirosi Yoshimoto, Mituo Sato, and Yasuhiro Nakao (Okayama Univ., Japan). J. Phys. Soc. Japan 13, 734-41(1958) July.

In the same manner as in glow discharge, the moving striations are observed in arc discharge. From the patterns of light oscillation, a light intensity wave traveling towards the cathode is obtained. The phenomenon of the moving striations is one manifestation of the light intensity wave which occurs due to an interaction between the following two waves, a space charge wave traveling towards the cathode and an electron density wave. The former changes the electron emission of the

cathode, and this produces the latter. The stationary striations observed in the positive column also seem to be one aspect of the light intensity wave. (auth)

14067

MOVING STRIATIONS DUE TO SPACE CHARGE WAVES. Hirosi Yoshimoto, Mituo Sato, and Yasuhiro Nakao (Okayama Univ., Japan). J. Phys. Soc. Japan 13, 741-8(1958) July.

In the positive column there exists a light intensity wave traveling towards the cathode. This wave is assumed to be proportional to the product of the electron density wave and the electric field wave. The equation for such a light intensity wave is considered. All the characteristic properties of the moving striations deduced from the analysis of the equation are presented here and are in favor to those of the observed moving striations. From the phenomena of the moving striations, the informations of the space charge waves in plasma can be obtained. (auth)

14068

SUPERSONIC MOTION OF VACUUM SPARK PLASMAS ALONG MAGNETIC FIELDS. D. Finkelstein (Stevens Inst. of Tech., Hoboken, N. J. and New York Univ.) and G. A. Sawyer and T. F. Stratton (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids 1, 188-92(1958) May-June.

Studies of plasmas produced by sparks in vacuum are reported. The observations of principal interest concern the speed with which such plasmas leave the spark. The conclusions about plasma speeds are that they are approximately ten times greater than the thermal speeds associated with spark temperature, varying between 2×10^6 and 2×10^7 cm/sec, and in the range observed, the velocities are approximately independent of the spark parameters. It is suggested that the pinch effect may be the mechanism of plasma acceleration. (auth)

14069

EFFECT OF CHARGE SEPARATION ON PLASMA DIFFUSION IN A STRONG MAGNETIC FIELD. A. N. Kaufman (Univ. of California, Livermore). Phys. Fluids 1, 252(1958) May-June.

Simon's treatment of the diffusion of like particles across a magnetic field (Phys. Rev. 100, 1557(1955)) is generalized to show that in a system isolated so as to allow charge separation, the resultant electric field grows to such a value as to effectively destroy the flux caused by ion-ion collisions. (J.S.R.)

14070

NEUTRON PRODUCTION IN LINEAR DEUTERIUM PINCHES. Oscar A. Anderson, William R. Baker, Stirling A. Colgate, John Ise, Jr., and Robert V. Pyle (Univ. of California, Berkeley and Livermore). Phys. Rev. 110, 1375-87(1958) June 15.

Approximately 10^8 neutrons per discharge have been observed from magnetically self-constricted columns of deuterium plasma. These neutrons originated uniformly and simultaneously along a filament at the center of the discharge tube, but measurements of their kinetic energies showed that they were produced by a small group of deuterons with large axial velocities and were therefore not of thermonuclear origin. It is proposed that the deuterons were accelerated by axial electric fields created by the growth of m = 0 ("sausage-type") instabilities. (auth)

14071

STABILIZED PINCH AND CONTROLLED FUSION POWER. S. A. Colgate and H. P. Furth (Univ. of California, Livermore). Science 128, 337-43(1958) Aug. 15.

A review is given of the history and current research on the stabilized pinch and controlled fusion power. The unstable pinch, stabilization of the pinch, and high-powered stabilized pinches are discussed. (J.S.R.)

14072

CERTAIN SOLUTIONS OF THE EQUATIONS OF PLASMA HYDRODYNAMICS. A. A. Vedenov (Moscow State Univ.). Soviet Phys. JETP 6, 1165-7(1958) June.

Exact solutions of the hydrodynamic equations of cold plasma in the presence of an external magnetic field and in its absence are considered. For the sake of simplicity, the ions are regarded at rest, but this restriction is not a fundamental one. (J.S.R.)

14073

GAS DISCHARGE IN MICROWAVE REGIONS. V. E. Golant. Uspekhi Fiz. Nauk 65, 39-86(1958) May. (In Russian)

A review is given of studies of gas discharge in the microwave regions. The review includes the publications of 1946 to 1957. (R.V.J.)

Electrons

14074

CALCULATION OF ELECTRON-ELECTRON SCATTERING. P. Stehle (Univ. of Pittsburgh). Phys. Rev. 110, 1458-60(1958) June 15.

The matrix elements involved in the calculation of electron-electron and positron-electron scattering are written down explicitly for a complete set of initial and final spin states of the particles. This permits the evaluation of the cross section for any polarization combination desired, with a minimum of labor. (auth)

14075

MØLLER SCATTERING OF ARBITRARILY POLARIZED ELECTRONS. A. Raczka and R. Raczka (Univ. of Warsaw). Phys. Rev. 110, 1469-71(1958) June. 15.

The electron-electron cross sections for arbitrarily polarized electrons have been evaluated, and the results are shown graphically. (A.C.)

14076

PAIR PRODUCTION AND BREMSSTRAHLUNG IN THE FIELD OF FREE AND BOUND ELECTRONS. J. Joseph and F. Rohrlich (State Univ. of Iowa, Iowa City). Revs. Modern Phys. 30, 354-68(1958) Apr.

The processes of bremsstrahlung and pair production are closely related, so that the respective scattering matrix elements have identical structure and can easily be obtained one from the other. Pair production is considered in detail and the corresponding results for bremsstrahlung deduced. (W.D.M.)

Gases

14077 AECU-3748

General Dynamics Corp. Electric Boat Div., Groton, Conn.

THERMODYNAMIC AND TRANSPORT PROPERTIES OF GASEOUS CARBON DIOXIDE. L. H. Chen. July 1957. 55p. Contract AT(04-3)-118. (TSD-57-001). $9.30(ph OTS); $3.60(mf OTS).

Thermodynamic and transport properties of gaseous carbon dioxide computed from the most recent data are presented. IBM high-speed digital computers were used, and the results are presented in graphical form with pressure and temperature as independent variables. The charts cover a range of temperatures from 0 to 1500°F and pressures up to 4000 psia. (J.R.D.)

14078 AECU-3785

Massachusetts Inst. of Tech., Cambridge and Brown Univ., Providence.

ON THE CALCULATION OF PROPERTIES OF GASES AT HIGH TEMPERATURES. Technical Report No. 2. I. Amdur and J. Ross. Aug. 1, 1958. 19p. Project NR-019-618. Sponsored by ONR and AEC under Contract Nonr-1841(23). $3.30(ph OTS); $2.40(mf OTS).

The role of the potential of intermolecular force in determining properties of gases at elevated temperatures is discussed. Coefficients of viscosity and self-diffusion, isotopic reduced thermal diffusion ratios, and second virial coefficients for helium, argon, and nitrogen at 1,000, 5,000, and 15,000°K were calculated from extrapolated potentials and from beam potentials. (W.D.M.)

14079 NP-6842

Massachusetts Inst. of Tech., Cambridge and Maryland. Univ., College Park. Inst. of Molecular Physics.

PROPERTIES OF GASES AT EXTREMELY HIGH TEMPERATURES. Technical Report No. 3. I. Amdur and E. A. Mason. Aug. 1, 1958. 51p. Project NR-019-618. Contracts Nonr-1841-(23) and AF18(600)-1562.

Known intermolecular force laws are used to calculate virial coefficients of the equation of state and the transport properties at very high temperatures for the rare gases and for molecular nitrogen. The crucial force laws which enable the calculations to be carried to high temperatures are those derived from molecular beam scattering measurements, which are valid at close distances of molecular approach. The calculations cover the temperature range from 1000 to 15,000°K, but take into account only the translational degrees of freedom and neglect the effects of excitation, dissociation, and ionization. The treatment of mixtures is outlined, and illustrated by calculations for the binary system helium-argon. The methods which are used offer an approach to the problem of obtaining reasonably accurate estimates of gas properties at temperatures so high that direct experiments would be extremely difficult, it not impossible. (auth)

14080

CALCULATION OF THE DIFFUSION COEFFICIENT OF DILUTE GASES AND OF THE SELF-DIFFUSION COEFFICIENT OF DENSE GASES. John C. Slattery and R. Byron Bird (Univ. of Wisconsin, Madison). A.I.Ch.E. Journal 4, 137-42(1958) June.

A corresponding-states correlation of low-density binary- and self-diffusion coefficients is presented. The equations are simple to use, are sufficiently accurate for most calculations, and correlate those data used in their derivation somewhat better than calculations based on the Lennard-Jones potential if potential parameters have to be estimated from the critical properties. The Enskog kinetic theory of dense gases is used in modified form to obtain an expression for the high-density diffusion coefficient for isotopic mixtures in terms of the viscosity and compressibility of the gas. Generalized viscosity and compressibility charts are then used to construct a graph for predicting a reduced self-diffusion coefficient as a function of reduced temperature $T_r = T/T_c$ and reduced pressure $p_r = p/p_c$. The effect of the pressure on the Schmidt number, $Sc = \mu/\rho D$, is also discussed. Finally the extension of this chart to nonisotopic mixtures is considered. (auth)

14081

THE VISCOSITY OF GASEOUS He, Ne, H_2 AND D_2 BELOW 80°K. J. M. J. Coremans, A. Van Itterbeek, J. J. M. Beenakker, H. F. P. Knaap, and P. Zandbergen (Kamerlingh Onnes Laboratorium, Leiden, Netherlands). Physica 24, 557-76(1958) July.

Measurements are reported of the coefficient of viscosity of He, Ne, H_2, and D_2 between 20 and 80°K, using an oscillating disc viscometer A simple thermostat, developed for this purpose, is also described. The results are in good agreement with the existing data below 20°K and above 60°K. In the course of the measurements a heretofore omitted correction of the oscillating disc measurements was found. With the aid of this correction, the existing discrepancies in the viscosity data below 4°K could be greatly reduced. Corrected values for the viscosity coefficient are given. The experimental results are compared with theoretical predictions based on the quantum-mechanical modification of the law of corresponding states. The first term of the series expansion of the reduced viscosity in powers of the De Broglie parameter is determined from the experimental data. Furthermore, the data are compared with calculations, based on different models for the intermolecular potential. (auth)

14082

THE SECOND VIRIAL COEFFICIENT OF BORON TRIFLUORIDE + NITROGEN MIXTURES. G. L. Brooks and C. J. G. Raw (Univ. of Natal, Pietermaritzburg, South Africa). Trans. Faraday Soc. 54, 972-4(1958) July.

An investigation of the second virial coefficient of boron trifluoride, and of mixtures of boron trifluoride and nitrogen at 30°C, has been made. The experimental results over a range of concentrations are found to be in good agreement with the theoretical values computed for the Lennard-Jones 12:6-potential, using the empirical combining laws for the potential parameters of mixtures. (auth)

Instruments

Refer also to abstracts 14454, 14455, 14461, 14462, 14466, and 14467.

14083 AERE-ES/M-27

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

DIDO REMOTE ACTIVE HANDLING FACILITY "FEEL" UNIT. K. J. Williams. June 1958. 15p. $0.63(BIS).

The magnetic induction strain gage transmitter and amplifier used to incorporate the sense of "feel" in the DIDO remote active handling facility are described. (T.R.H.)

14084 AERE-R/M-159

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A VARIABLE AREA FLOWMETER USING RADIOACTIVE ISOTOPE TECHNIQUES. P. T. Blacker and D. M. Harris. June 1958. 9p.

A variable area flowmeter is described in which a collimated beam of γ rays is interrupted by a tapered float. The degree of absorption of the γ-ray beam by the float is used as a measure of flow rate. Calibration curves and a discussion on possible development are included. (auth)

14085 AFOSR-TN-58-387

Aachen. Technischen Hoshscule. Institut fur Mechanik and Maryland. Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

MEASUREMENTS OF THE BOUNDARY LAYER THICKNESS AND RELAXATION OF IONIZATION BEHIND STRONG SHOCK WAVES WITH A NEW CAPACITIVE PROBE. Technical Note No. 1. A. H. Groenig and H. D. Weymann. Feb. 1958. 29p. Contract AF61(514)-1046. (AD-154294).

The measurement of the thickness of the boundary layer with a capacity probe is described. This probe flush inserted into the wall of the shock tube and thus avoiding any disturbances in the flow is sensitive to the thickness of the boundary layer, when the gas in the undisturbed flow is ionized. The experimental results for argon at Mach numbers between 5 and 10 show the usefulness of the probe for measuring the thickness of the boundary layer, the relaxation time of ionization and the coefficient of diffusion. (auth)

14086 CF-58-2-3
Oak Ridge National Lab., Tenn.
DEVELOPMENT OF A FAST-RELEASE ELECTROMAGNET FOR POOL-TYPE RESEARCH REACTORS. C. Michelson. Feb. 14, 1958. 47p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

Experimental data and observations of the design parameters and physical configurations which lead to faster-release cylindrical flat-faced electromagnets are given. Detailed drawings and operating characteristics are presented for an electromagnet suited to the requirements of a pool-type research reactor using either gravity drop or additional accelerating force. This electromagnet embodies the experimentally developed techniques for attaining fast release. (auth)

14087 CREL-767
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
TRANSISTORIZED COUNTING SYSTEMS. 1. Basic Transistor Trigger Circuits used in the Counting Systems. F. S. Goulding. June 1958. 38p. (AECL-658). $1.00(AECL).

A description of a basic trigger circuit element containing two similar (i.e., n-p-n or p-n-p) transistors is presented. The circuit employs coupling between emitters and from one collector to the other base with clamping diodes serving the dual function of stabilizing operating conditions and preventing collector saturation in both transistors. Suitable choice of component values and voltage supplies yields circuits capable of astable, mono-stable, or bistable operation. The virtues claimed for the circuit include a high impedance sensitive input, a low impedance output point, and also an output point which is external to the feed-back loop and which can therefore be loaded in any reasonable way without affecting circuit operation. Variants of the basic circuit which provide a fast recovery, accurate trigger threshold, and a variety of other features are described. A complementary pair (i.e., p-n-p & n-p-n) transistor circuit which may be used as a relay driver is also described. (auth)

14088 KAPL-1238
Knolls Atomic Power Lab., Schenectady, N. Y.
A ZERO-STABILIZED AMPLIFIER FOR REACTOR CONTROL. E. J. Wade and R. S. Stone. Jan. 15, 1954. Changed from OFFICIAL USE ONLY June 26, 1956. 27p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

A brief description of a d-c amplifier which was developed for reactor control and monitoring at KAPL is given. This amplifier is unique in that it is both extremely fast and evidences no zero drift over the entire range of sensitivity. A trip blanking circuit prevents the trip action during range switching. (auth)

14089 SCTM-223-58(14)
Sandia Corp., Albuquerque, N. Mex.
ROTA-FORM COIL WINDER. Paul L. Kerley and R. H. Opperman. July 3, 1958. 6p. Contract AT(29-1)-789. $1.80(ph OTS); $1.80(mf OTS).

The object of this machine is to wind layer-wound transformer coils on uncut "C" cores. Since the coils obviously cannot be wound and then inserted around the core, they must either be hand-wound on the core by means of a "shuttle" containing the required amount of wire, or wound on a torroidal winding machine with window-winding attachment. (auth)

14090 SCTM-250-58(14)
Sandia Corp., Albuquerque, N. Mex.
ANTENNA ANALYSIS BY CIRCUIT SUPERPOSITION. C. W. Harrison, Jr. June 12, 1958. 34p. Contract AT(29-1)-789. $6.30(ph OTS); $3.00(mf OTS).

The principle of superposition of circuits permits one to synthesize a variety of antennas of utilitarian value in the field of telemetry from a knowledge of the driving point impedance of an inverted L-antenna with image, the T-antenna with image, and appropriate open-wire or coaxial transmission line sections. One such antenna of particular interest is a shunt-driven bent three-wire monopole. It is shown that this structure may be analyzed. Other antennas that may be evolved easily from L- and T-structures include L- and T-antennas with similarly configured parasitic elements, bar-loaded folded monopoles, etc. Many of these antennas are discussed. (auth)

14091 UCRL-8227
California. Univ., Berkeley. Radiation Lab.
A GENERATOR OF FAST-RISING LIGHT PULSES FOR PHOTOTUBE TESTING. Quentin A. Kerns, Frederick A. Kirsten, and Gerald C. Cox. Mar. 24, 1958. 35p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

The UCRL light-pulse generator provides flashes of light accompanied by electrical pulses generated at an impedance level of 50 ohms. The usual repetition rate is 60 cps. The 10 to 90% rise, both for the light and for the electrical pulse, is less than 0.5 mμsec. The light pulse rises and then falls to 50% peak amplitude in less than 1.5 mμsec. The time relation between the light and electrical pulses is fixed. The electrical pulse power available is large. In conjunction with an oscilloscope, the light-pulse generator has proved useful in the testing and evaluation of multiplier phototubes and low-light-level image devices. Time resolution of 10^{-10} second is typical of measurements made with conventional fast oscilloscopes (e.g., Tektronix 517), while elaboration of technique permits relative time measurements that are better in some cases by at least three orders of magnitude. The light is emitted from a region a few mils in diameter, and thus may often be considered to come from a point source. An S4 photosurface subtending 0.1 steradian at the light source emits photoelectrically about 10^7 electrons per steradian per pulse. For convenience, three decoupled electrical out-put channels are provided, together with a polaroid attenuator for the light pulse. (auth)

14092 SCL-T-191
AN ELECTRICAL TELETHERMOMETER FOR METEOROLOGICAL MEASUREMENTS, FUNCTIONING WITH A THERMISTOR. (Mit Thermistor Funkstionierendes

Elektrisches Fernthermometer Zu Meteorologischen Messungen). Georg Goll. Translated by Marcel I. Weinreich (Sandia Corp.) from Idöjaràs 61, 230-3(1957). 9p.

The construction and operation of a temperature measuring device consisting of simple components and offering precision required by meteorological needs are described. The device allows for easy thermistor measurements. (J.R.D.)

14093

A RECORDING SPECTRAL PHOTOMETER FOR THE ULTRAVIOLET, VISIBLE AND NEAR INFRARED REGION. Gerhard Geppert (Institut fur organische Grundstoffchemie, Leipzig). Exptl. Tech. Phys. 6, 79-84(1958). (In German)

The design and construction of a spectrophotometer for the ultraviolet, visible, and near infrared regions are described. The reproducibility and linearity of the instrument are good. (J.S.R.)

14094

PHOTOMETRIC RECORDING OF CHARGED PARTICLES IN PHOTOEMULSION. B. A. Voikovskii, A. I. Galaktionov, M. I. Tret'yakova, and A. E. Chudakov (Lebedev Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 6, 38-42(1957) Nov.-Dec. (In Russian)

Photometers with a narrow slot and possessing an integrator to record the general blackening of the measured track section are described. Data from proton and π meson tracks in photoplates and protons, π mesons, and τ mesons in non-lined emulsion layers are presented. (tr-auth)

14095

APPARATUS FOR MEASURING THE LENGTH AND THE NUMBER OF SEGMENTS ON CHARGED PARTICLE TRACKS IN PHOTOEMULSIONS. B. A. Voikovskii, A. I. Galaktionov, and M. I. Tret'yakova (Lebedev Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 6, 42-5(1957) Nov.-Dec. (In Russian)

An apparatus for recording simultaneously the length of a charged particle track in a photoemulsion, the number of segments, and the length of each segment is described. Diagrams are plotted for the differential and integral length of segments for protons and π-mesons in photoplates and emulsion layers. (tr-auth)

14096

A DEVICE FOR AUTOMATIC DETERMINATION OF SMALL HETEROGENEITIES IN ALTERNATING MAGNETIC FIELDS. A. P. Komar and V. P. Yashukov (Inst. of Physics and Tech., Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 6, 75-8(1957) Nov.-Dec. (In Russian)

Descriptions are given of a device for observing magnetic field heterogeneities appearing due to small amplitude of phase differences in various sections of electromagnet gaps. The device is quite effective in adjusting accelerator electromagnets. (tr-auth)

14097

FRACTIONAL-MILLIMICROSECOND OSCILLOSCOPE SYSTEM UTILIZING COMMERCIALLY AVAILABLE COMPONENTS. C. Norman Winningstad (Univ. of California, Berkeley). Rev. Sci. Instr. 29, 578-84(1958) July.

Equipment for use with signal rise times slower than a millimicrosecond is readily available commercially. Recent advances in high-energy physics have directed attention toward research in the fractional-mμsec region. The fundamental tools for such research are pulse generators and oscilloscopes. Suitable pulse generators are commercially available, but suitable oscilloscope systems are not. There are two important factors that account for the lack of such oscilloscopes. One is that contemporary amplifiers are useless in the fractional-mμsec region. The second is that output timing in commonly used trigger circuits is too sensitive to changes in input amplitude. This paper describes an internally synchronized oscilloscope system utilizing commercially available components, which provides less than 2% signal reflection at the sync takeoff point, and has less than 5×10^{-12} second of sweep-timing change per percent change in input amplitude (for amplitudes in excess of 30 trace widths). (auth)

14098

ELECTRON MICROSCOPY AND ITS USES IN PHYSICO-CHEMICAL STUDIES. V. M. Luk'yanov. Uspekhi Khim. 27, 690-716(1958) June. (In Russian)

A review is given of the up-to-date methods and scientific fields of electron microscopy investigations. 146 references. (R.V.J.)

Isotopes

14099

THE DISTRIBUTION OF RADIOACTIVE ISOTOPES. Roman Broszkiewicz (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Nukleonika 3, 329-34 (1958). (In Polish)

The present position and the methods used in the distribution of radioactive isotopes at home and abroad are discussed. Types of isotopes produced in various countries and the range of labeled chemical compounds are described. (tr-auth)

Isotope Separation

Refer also to abstract 14452.

14100 ORNL-2482

Oak Ridge National Lab., Tenn.

CHEMISTRY ASSOCIATED WITH THE ELECTROMAGNETIC SEPARATION OF CHROMIUM ISOTOPES. Boyd Weaver, R. L. Bailey, W. C. Davis, F. M. Scheitlin, C. W. Sheridan, and F. B. Thomas. Aug. 14, 1958. 7p. $0.50(OTS).

Chemical research and production efforts which support the electromagnetic separation of the stable isotopes of chromium include the preparation of charge material, removal of separated material from collectors, and product purification. (auth)

14101 TID-5229

Naval Research Lab., Washington, D. C.

LIQUID THERMAL DIFFUSION. Philip H. Abelson, Nathan Rosen, and John I. Hoover, eds. Sept. 10, 1946. Decl. Feb. 12, 1957. TISE Issuance date Aug. 1958. 258p. (NRL-0-2982). $4.00(OTS).

A revised and expanded version of NNES-IX-1.

The liquid thermal diffusion method for the separation of isotopes is described. The discussion includes the experimental aspects of the method, description of equipment, and the theoretical aspects of the process as applied to the design, development, and performance criteria. A short history of the liquid thermal diffusion method from 1940 to 1945 is presented along with a survey of relevant literature prior to 1940. The re-

mainder of the report is concerned with theoretical aspects. (J.R.D.)

14102 AEC-tr-3318

FIRST EXPERIMENT ON THE DOUBLE MONOCHROMATION IN THE ELECTROMAGNETIC SEPARATION OF ISOTOPES. Charles Cassignol. Translated by Oak Ridge National Lab. Library Staff from J. Phys. Radium 17, Suppl. 11, 113A-15A(1956). 7p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 2870.

14103 IGRL-T/CA-73

A PROCESS FOR SEPARATING MIXTURES OF ISOTOPES BY DIFFUSION IN A STREAM OF MERCURY VAPOUR. G. Hertz. Translated by B. Rigby (U.K.A.E.A. Industrial Group, Capenhurst) from Z. Physik 91, 810-15(1934). 8p.

The process for separating mixtures of isotopes is improved by replacing diffusion through a porous wall by diffusion in a stream of mercury vapor. For this purpose a specially constructed diffusion pump was used which had the property of preferentially pumping the faster diffusing component. An apparatus, consisting of twelve such stages, causes a change in the ratio of the isotopes of neon by a factor of ten. (auth)

14104

EVALUATION OF ISOTOPE SEPARATION PROCESSES. G. A. Garrett and J. Shacter (Union Carbide Nuclear Co., Oak Ridge, Tenn.). Chapter 2 of Proc. Symposium on Isotope Separation, Amsterdam, 17-32(1957).

Typical procedures are outlined for designing an isotope separation facility, starting with basic laboratory data on the process being considered, basic engineering cost data, and assumptions regarding production requirements. Such procedures give an indication of the chance of commercial application of a separation process and a basis for selection among competing processes. Some rather simple relationships may often be applied to eliminate from consideration processes which are virtually hopeless. When the competition among processes is closer, it is necessary to analyze them more carefully. The basis for such an analysis is the process design of the practical cascade which results in minimum costs. It is particularly interesting to consider the "shape" of practical cascades, where the cascade shape is characterized by its "length", which is the number of stages in series, and the "width" at any point is the interstage flow rate. Some of the more important factors affecting isotope separation cascade construction and operating costs for various processes are discussed and it is shown how these factors influence the shapes of practical cascades, which may be appreciably different from those of "ideal" cascades. For example, where the process economics are dominated by the costs which are proportional to the total interstage flow rates, the practical cascade shape will closely approximate that of the ideal cascade. On the other hand, if the costs associated with the total interstage flows are relatively minor, the optimum cascade shape may be one which is shorter and wider than the ideal cascade or it may be longer and narrower than the ideal cascade. Our procedures are illustrated by applying them to the chemical exchange process developed by Dr. T. I. Taylor and Dr. W. Spindel of Columbia University for the production of N^{15}. In this process the major costs are the chemical costs, which are proportional to the maximum interstage flow rate, not the total interstage flow rate, and the practical cascade design tends to minimize this maximum flow rate, resulting in a long narrow cascade. (auth)

14105

SOME EXPERIMENTS ON THE SEPARATION OF LITHIUM ISOTOPES BY MOLECULAR DISTILLATION. D. B. Trauger, J. J. Keyes, Jr., G. A. Kuipers, and D. M. Lang (Union Carbide Nuclear Co., Oak Ridge, Tenn.). Chapter 27 of Proc. Symposium on Isotope Separation, Amsterdam, 350-67(1957).

Molecular, or short-path high-vacuum distillation, has been recognized for some time as a promising means for separation of the isotopes of liquid metals, particularly in view of the simplicity of equipment and the relatively high separation factor attainable. The method has been used to separate the isotopes of mercury; Brewer and Madorsky used multistage stills, and earlier workers used single stage stills. The work reported here covers a series of experiments carried out in the laboratories of the Oak Ridge Gaseous Diffusion Plant to determine the usefulness of the method for the separation of the isotopes of lithium. The experiments covered the period from 1952 through 1954 and included: (1) exploratory experiments to determine the single stage separation factor, to study the condenser drainage problem, and to determine suitable construction materials for a still; (2) the operation of a small circular still with spiral staging; (3) the operation of two different versions of a larger horizontal eight-stage still; and finally, (4) the successful operation of a six-stage still with horizontal evaporating and condensing surfaces. Operation over the temperature range from 535°C to 627°C showed stage separation factors of 1.052 to 1.064. (auth)

14106

PARAMETERS OF THERMAL DIFFUSION COLUMNS. G. R. Grove, K. W. Foster, and R. E. Vallee (Mound Lab., Miamisburg, Ohio). Chapter 35 of Proc. Symposium on Isotope Separation, Amsterdam, 462-70(1957).

Estimations of hot-wire thermal diffusion separations of non-Maxwellian gases have associated uncertainties which are due in part to the use of cylindricity corrections calculated for a Maxwellian gas (N = 1). Separation with no draw-off of mixtures of hydrogen and helium ($N \approx 2/3$) were studied. From data obtained for pressures of maximum separation, equilibrium separation values, and rates of approach to equilibrium, thermal column shape factors were determined in the geometric range $15 < r_1/r_2 < 100$ and the temperature range $2 < T_2/T_1 < 4$. The effective values of the transport, convection, and diffusion shape factors were found to be sufficiently different from those of a Maxwellian gas. Thus, the effect of the non-Maxwellian characteristic of gas mixtures should be taken into account in the optimum design of a critical separation facility. (auth)

Mass Spectrography

14107

MASS SPECTROMETER IMAGE DISPLACEMENTS DUE TO SECOND-ORDER ABERRATIONS. Charles F. Robinson (Consolidated Electrodynamics Corp., Pasadena, Calif.). Rev. Sci. Instr. 29, 622-4(1958) July.

Second-order aberrations in mass spectrometers give rise to image broadening which is generally unsymmetrical about the optic axis, resulting in a net displacement of the image center from the optic axis. The net displacement depends on the properties of the mass resolving system and on the velocity and angular distri-

bution in the ion beam. In the event different ionic species may possess either different mean kinetic energies or different energy distributions, the image shifts may differ appreciably, leading to small but appreciable errors in mass doublet measurements. (auth)

14108

INCLINATION AND CURVATURE OF THE DIRECTION AND ENERGY FOCUSING CURVES IN THE DOUBLE FOCUSING MASS SPECTROGRAPH. H. Liebl (Technischen Hochschule, Munich). Z. Naturforsch. 13a, 490(1958) June.

Equations for the inclination and curvature of the directional and energy focusing curves in a double-focusing mass spectrograph were set up and solved for various spectrographs. The results are tabulated. (J.S.R.)

Mathematics

14109 AECU-3635(2nd Ed.)

Illinois. Univ., Urbana. Digital Computer Lab.
ON THE DESIGN OF A VERY HIGH-SPEED COMPUTER. Report No. 80. D. B. Gillies, R. E. Meagher, D. E. Muller, R. W. McKay, J. P. Nash, J. E. Robertson, and A. H. Taub. Oct. 1957. Second Edition (Revised in Part – Apr. 1958). 236p. Contract AT(11-1)-415. $36.30(ph OTS); $10.20(mf OTS).

The feasibility of constructing a digital computer about one hundred times faster than present computers, such as ILLIAC, using transistorized circuits and other presently available components and techniques is reported. The results of two design studies are discussed. One involves a minimum of buffer storage in the form of transistor registers, and the other involves a moderate amount of buffer storage in the form of a small-capacity, high-speed, random-access buffer memory. The former design is emphasized because its equipment requirements can be presently met. Two controls are used, arithmetic control and advanced control, as well as buffer storage for instructions and operands, and by such means various units of the computer are kept in simultaneous operation. The relative speed of the proposed computer compared to that of existing machines depends upon the problem. For problems dominated by arithmetic operations, it is estimated that the proposed computer will be 100 to 200 times faster than computers such as ILLIAC. For problems dominated by logical and combinatorial operations, the gain in speed will be at least 50 times. The computer has a random-access word-arrangement memory of 8192 words of 52 units each with an access time of 1.5 μsec. The arithmetic unit is designed so that the digits of a multiplier are sensed and acted upon in such a way that the use of the adder is reduced. Also, "carry registers" are used in this unit, and carriers are assimilated only when necessary. The computer will have an average multiplication time between 3.5 and 4 μsec, addition times of 0.3 μsec, and division times of 7 to 20 μsec. The computer, aside from input-output facilities, will contain approximately 15,400 transistors, 34,000 diodes, and 42,000 resistors. The basic circuits built from these transistors have operation times of 5 to 40 × 10^{-9} sec, depending upon the circuit. (auth)

14110 APEX-378

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
OPTIMIZING NUCLEAR DESIGNS BY MEANS OF NON-LINEAR PROGRAMMING. D. S. Selengut. Oct. 14, 1957. 19p. (XDC-57-10-112). $3.30(ph OTS); $2.40 (mf OTS).

The mathematical problem of non-linear programming consists of maximizing a function $f_0(x_1 \ldots x_n)$ of n independent variables, subject to constraints in the form of inequalities, $f_m(x_1 \ldots x_n) \geq 0$. If the independent variables are considered the design parameters and the function to be maximized describes the system performance, this set of equations is equivalent to the general problem of optimizing a complex engineering system. The case where the performance can be approximated by a quadratic function of the design variables and the constraints by upper and lower bounds is sufficient to exhibit the general properties of the system performance near the design point. Because the constraints are in the form of inequalities, usual calculus of variations techniques cannot be applied. However, an iterative procedure suitable for machine computation has been developed which is comparable in efficiency to the Gauss-Seidel solution of n simultaneous algebraic equations. A computer program has been coded which will allow the optimization of a system containing up to 25 independent variables, subject to limit constraints. An example is discussed in which the radial power distribution in a hypothetical reactor is flattened by varying reflector thickness and core composition, subject to limits on maximum thickness and fuel loadings of various regions. Details of the FORTRAN source program for the 704 are given in the Appendix. (auth)

14111 GMR-101

General Motors Corp. Research Staff, Detroit.
GNU II—A MULTIGROUP ONE-DIMENSION-DIFFUSION PROGRAM FOR THE IBM 704. C. L. Davis, J. M. Bookston, and B. E. Smith. Nov. 12, 1957. 210p.

The GNU II Code, an IBM 704 program, which is a multigroup, multiregion, one-dimension approximation to the neutron diffusion equation is described. Problem statement, description of input and output, flow diagrams, and listings are included. (auth)

14112 NYO-8670

New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
SOLVING STRUCTURAL MECHANICS PROBLEMS ON DIGITAL COMPUTERS. H. J. Greenberg. July 11, 1958. 52p. Contract AT(30-1)-1480. $9.30(ph OTS); $3.60(mf OTS).

A short critical survey of the current applications of digital computers to solving problems in structural mechanics is presented. A brief description of typical medium and large size computing systems, a list of standard mathematics problems to which structural mechanics problems commonly reduce for which adequate codes exist together with a list of these codes for both machines, an informal survey of mechanics codes completed and under development at representative centers, a detailed discussion of three advanced computer applications, and recommendations for future work in this field are included. (auth)

14113 SCR-40

Sandia Corp., Albuquerque, N. Mex.
THE VANISHING COEFFICIENTS IN SERIES EXPANSIONS OF PERIODIC DISTRIBUTION FUNCTIONS. T. E. VanZandt. July 1958. 10p. Contract AT(29-1)-789. $1.80(ph OTS); $1.80(mf OTS).

Presented at the Gaseous Electronics Conference, Pittsburgh, October 31—November 3, 1956.

When the velocity distribution function is expanded in

a series of orthogonal functions, the vanishing coefficients can be determined prior to solving Boltzmann's equation either by reasoning whether each term can or cannot be generated by the applied force, or by requiring that each nonvanishing term be functionally invariant under the same transformations which leave invariant the boundaries and Boltzmann's equation with the given force. The latter condition is briefly derived, and results as obtained with it are presented for several configurations of force and boundaries. (auth)

14114 SCTM-304-58(51)
Sandia Corp., Albuquerque, N. Mex.
AN ACCEPTANCE TEST FOR ITEMS CHARACTERIZED BY TWO INDEPENDENT, NORMALLY DISTRIBUTED MEASUREMENTS. E. J. Gilbert. Aug. 14, 1958. 8p. Contract AT(29-1)-789. $1.80(ph OTS); $1.80(mf OTS).

An acceptance test is proposed for the situation in which an item is characterized by two independent, normally distributed measurements X and Y, and it is desired to reject items for which P (X > 0 and Y > 0) $\leq P_0$ with given confidence γ_0. The operating-characteristic curve of the proposed test is derived, and an example is worked out to illustrate the method. (auth)

14115 AEC-tr-2998
ON THE CONCEPT OF ENTROPY OF A FINITE PROBABILISTIC SCHEME. D. K. Fadeev. Translated by the Oak Ridge National Lab. Library Staff from Uspekhi. Mat. Nauk 11, 227-31(1956). 7p.

The entropy of the finite probability scheme having previously been characterized by a system of axioms, an attempt to simplify the system of axioms is offered. (T.R.H.)

14116 NP-tr-135
QUASI-MOMENT FUNCTIONS IN THE THEORY OF RANDOM PROCESSES. P. I. Kuznetsov, R. L. Stratonovich, and V. I. Tikhonov. Translated by J. McFadden (Lincoln Lab., MIT) from Doklady Akad. Nauk S.S.S.R. 94, 615-18(1951). 7p.

14117 NP-tr-136
ON THE DISTRIBUTION OF THE MODULUS OF THE MAXIMUM DEVIATION FROM THE MEAN IN A NUMBER OF OBSERVATIONS. A. M. Benderskii. Translated by J. McFadden (Lincoln Lab., MIT) from Doklady Akad. Nauk S.S.S.R. 85, 5-8(1952). 6p.

14118 NP-tr-137
ON THE RATE OF CONVERGENCE OF THE ITERATION PROCESS OF A DIFFERENCE SOLUTION OF THE DIRICHLET PROBLEM FOR THE LAPLACE EQUATION. M. A. Aleksidze. Translated by Morris D. Friedman (Lincoln Lab., MIT) from Doklady Akad. Nauk S.S.S.R. 120, 9-12(1958). 6p.

14119
THE INVARIANCE PROPERTIES OF THE FIELD LAGRANGE FUNCTIONS. Nikolaj Mizkjewitsch (Lomonossov State Univ., Moscow). Ann. Physik 1, 319-33(1958). (In German)

An investigation was made of the analytical form of the invariance conditions for the functions of field magnitude and its first two derivatives were obtained. The functions were identified with the physical Lagrange functions. The permanent magnitudes were classified by means of a new formulation of the Noether theorem. A new type of unitary field theory was formulated for fields with vanishing rest masses of the quanta. (tr-auth)

14120
METHODS FOR NUMERICAL CALCULATIONS WITH THE TYPE I COUNTER. P. G. Guest (Univ. of Sydney). Australian J. Phys. 2, 143-53(1958) June.

Detailed schemes have been prepared for performing numerical calculations of frequency, expectation, and variance. Tables are given of the deviations of the asymptotic formulas from the exact formulas when the time of observation is small. (auth)

14121
ON THE APPLICATION OF AN ELECTRONIC DIFFERENTIAL ANALYSER FOR FINDING THE ROOTS OF A POLYNOMIAL. B. R. Nag (Calcutta Univ.). Indian J. Phys. 32, 212-17(1958) May.

A method of finding the roots of a polynomial with real coefficients by an electronic differential analyzer is described. The principle underlying the method is to set up in the analyzer a system having a transfer function, of which the numerator is the polynomial whose roots are to be obtained. The denominator of the transfer function is a suitable chosen polynomial. Roots of the polynomial are then obtained by determining the frequencies at which the system gives zero output. (auth)

14122
VARIATIONAL APPROACH TO MAGNETOHYDRODYNAMICS. Philip Rosen (Univ. of Massachusetts, Amherst). Phys. Fluids 1, 251(1958) May–June.

Measuring Instruments and Techniques

Refer also to abstracts 13646 and 13647.

14123 APEX-375
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
OPTIMIZATION OF FISSION FRAGMENT CATCHER FOIL EXPOSURE TIME. J. N. Renaker and R. G. Clark. Jan. 8, 1958. (XDC-58-1-63). $3.30(ph OTS); $2.40(mf OTS).

The exposure time for fission fragment catcher foils, used in nuclear reactor power mapping, was arbitrarily set at 20 minutes. Work performed to evaluate this choice and to attempt an optimization of the exposure time is reported. A true optimum was not found. Forty minute runs are suggested, however, as a practical optimization and as an alternative to the 20 minute runs in current usage. (auth)

14124 HW-52787(Rev.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A SCINTILLATION TRANSISTORIZED ALPHA HAND COUNTER. W. G. Spear. Mar. 19, 1958. 18p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A scintillation transistorized alpha hand counter was developed which can reliably detect and indicate plutonium alpha contamination with activity levels less than one-hundred d/m versus the present four-fold sensitivity limit of 500 d/m to 1000 d/m. The experimental instrument was operated continuously for four months by Hanford Laboratory personnel, with no maintenance or recalibration costs. The new instrument is less than one-third as large as the four-fold instrument. (auth)

14125 MTec-168
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
ION-CHAMBER DATA. H. Carmichael. Aug. 17, 1945. Decl. Sept. 23, 1954. 22p. (AECL-290). $0.50(AECL).

The operational characteristics of all the large ion chambers designed for the Chalk River Plant are discussed and, in the case of the chambers for safeguarding personnel, the currents corresponding to the biological toleration intensities of γ rays, fast neutrons, and slow neutrons are deduced. (auth)

14126 MURA-416

Midwestern Universities Research Assn., Madison, Wis.

CURRENT STATUS OF THE LUMINESCENT CHAMBER. Lawrence W. Jones. July 31, 1958. 36p. Contract AT(11-1)-384. $6.30(ph OTS); $3.00(mf OTS).

The nature of the luminescent chamber as a tool in high-energy physics research is discussed, and problems and their solution in constructing such a chamber are outlined. Characteristics of solid and filament scintillators, photographic film, and available image intensifier tubes are presented. Particular attention is given to regenerative light amplification and its application to track viewing. Image tubes under development and other possible systems are outlined. It is concluded that the luminescent chamber should soon become a practical, useful instrument. (auth)

14127 NARF-58-30T

Convair, Fort Worth, Tex.

CONVAIR REMOTE-AREA FAST-NEUTRON MONITOR. A. H. Smith. Aug. 4, 1958. 30p. Project 6(1-9964). Contract AF36(600)-32054. (MR-N-182).

A multichannel system of remotely operated, fast neutron detectors for dose rate measurements to 20 rem/hr in the energy range from 0.1 to 10 Mev is described. The application of this system in health physics monitoring of neutron dose rates in reactor operation areas is discussed. A general description of the electronic system is followed by a detailed consideration of the system broken down into its functional units: a detector preamplifier, linear amplifier, pulse shaping network, digital-to-analog conversion network, difference amplifier, and dose rate recorder. (auth)

14128 NARF-58-33T

Convair, Fort Worth, Tex.

THERMAL NEUTRON CAPTURE IN THE ANTHRACENE SCINTILLATION DOSIMETER. J. B. Moore and G. E. De Vore. July 29, 1958. 19p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-217).

The gamma dose rate resulting from thermal neutron capture in various components of the anthracene scintillation dosimeter (ASD) was calculated. The calculated gamma dose rate, in terms of the incident thermal neutron flux, is $4.00(10^{-4})$mrem/hr per thermal neutrons/cm^2 sec. To augment the analytical results, one component, that from the metal shield was determined experimentally. The measured value was 20% lower than the calculated value for the metal shield. It is concluded that gamma dose rates measured with an ASD should be corrected for thermal neutron capture gammas when measurements are made in a radiation field which has a thermal neutron flux-to-gamma dose rate ratio greater than 250. (auth)

14129 NP-6870

Ansco Div., General Aniline and Film Corp., Binghamton, N. Y.

GAMMA-RAY INSENSITIVE EMULSIONS. Quarterly Report No. 8 [for] January 1, 1958–March 31, 1958. D. A. Nepela and H. F. Nitka. 13p. Contract DA-36-039-sc-70172.

Work on the possibility of recovering gamma-irradiated film for a subsequent light exposure was continued. This work covered the determination of the speed loss encountered as a function of the internal image density. Further experiments were carried out with an emulsion having a high-intensity reciprocity failure, in the hope that such an emulsion would be advantageous for obtaining a favorable light to gamma-speed ratio. This expectation was realized. The contrast loss experienced in a reversal image after uniform gamma-irradiation can be recovered considerably by subsequent high-contrast printing on autopositive film. (For preceding period see NP-6665.) (auth)

14130 AEC-tr-3322

ON AN EXPERIMENTAL METHOD FOR THE MEASUREMENT OF MOLECULAR RADIATION. (Uber eine experimentelle Methode zur Messung von Molekularstrahlung.) Herbert Mayer. Translated by E. David Cater (Argonne National Lab.) from Z. Physik 52, 235-48(1928). 17p.

A torsion method for measurement of the intensity of molecular beams is described, and as a first application, an experimental test and verification of the cosine law of molecular radiation is communicated. (auth)

14131

A CHARGING UNIT WITH AN ATOMIC BATTERY. G. D. Gorlovoi and E. G. Kardash. Atomnaya Energ. 4, 382-3(1958) Apr. (In Russian)

The scheme and performance of a pocket dosimeter with atomic charge element are described. (R.V.J.)

14132

VOLTAGE-CURRENT CHARACTERISTICS OF BORON IONIZATION CHAMBERS. A. B. Dmitriev. Atomnaya Energ. 4, 383-5(1958) Apr. (In Russian)

The voltage-current characteristics and performance of various types of boron ionization chambers are plotted and tabulated. (R.V.J.)

14133

DETERMINATION OF ThX AND RdTh IN BIOLOGICAL MEDIA BY THE TORON'S METHOD. E. V. Tokmakova and A. D. Turkin. Med. Radiol. 3, 61-5(1958) May-June. (In Russian)

An emanation method of determination of ThX and RdTh in biological media was developed which allowed to measure their minimal quantities (about 5.5×10^{-2} C) on the electrometer of ST-IM type. The degree of equilibrium between RdTh and ThX in excretions by this method may be practically determined. (tr-auth)

14134

CHARGING DEVICE FOR POCKET DOSIMETERS. E. V. Utekhin (Central Research Inst. of Roentgen-Radiology, Ministry of Health, USSR). Med. Radiol. 3, 68-9(1958) May-June. (In Russian)

The scheme is presented for a pocket dosimeter recharge device. (R.V.J.)

14135

MEASUREMENT OF THE RISE-TIME OF IMPULSES IN BF_3 PROPORTIONAL COUNTERS. W. Dabek and A. Kazimierski (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Nukleonika 3, 299-312(1958). (In Polish)

A method is described of measuring the rise-time of impulses in a proportional counter. The method is based on the measurement of changes in impulse amplitude produced by the application of differentiating and integrating circuits. The amplifier used in the measurements had a known constant integration time and an additional differentiating circuit of variable time constant. The impulse rise-times measured in

three types of proportional counters amounted to 0.3 to 0.9 μsec. (tr-auth)

14136

NUCLEAR PARTICLE TRACK PHOTOGRAPHY IN ELECTRIC FIELDS. I. E. Bock (Clarendon Lab., Oxford). Phil. Mag. (8) 3, 715-17(1958) July.

A method is proposed whereby the light emitted by liquid scintillators may be increased by application of a suitable a-c field. By this means the light output may be increased amply to allow minimum ionizing tracks to be recorded photographically without the possibility of instability arising. (auth)

14137

DOSIMETER FOR HIGH ENERGY NEUTRONS. P. S. Baranov, V. I. Gol'danskii, and V. S. Roganov (Lebedev Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 6, 45-9(1957) Nov.-Dec. (In Russian)

A neutron detector with a 20.6-Mev threshold, based on the reaction $C^{12}(n,2n)C^{11}$ in liquid organic scintillators, is described. The detector efficiency does not depend on neutrons in the interval ~40 to 400 Mev. The detector is capable of recording a high-energy flux to an accuracy of 6%. (tr-auth)

14138

ON THE LIFE SPAN OF RADIOACTIVE RADIATION COUNTERS FILLED WITH ARGON-METHYLAL. L. S. Eig and V. G. Chaikovskii. Pribory i Tekh. Ekspt. No. 6, 49-54(1957) Nov.-Dec. (In Russian)

Mass spectrometric analyses were made of argon–methylal counters during their performance. The results were correlated with the variation in their characteristics. While some products of methylal decay recovered to a certain degree during the counter rest, the substances with mass 16 and 28 remain unchanged. The mass 16 is obviously related to the atomic oxygen which interferes with the restoration process. It was found that after recording 1×10^8 pulses the counter acquires an increased sensitivity to visual light; however, the sensitivity is reduced after the counter rest period. (tr-auth)

14139

USE OF FREONS IN BUBBLE CHAMBERS. David V. Bugg (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 29, 587-9(1958) July.

The sensitive regions of several Freons in a bubble chamber have been determined. CF_3Br, Freon 13B1, has been found to be sensitive at 30°C, at which temperature the equilibrium vapor pressure is only 264 psi. Because of its pleasant handling characteristics, and the fact that it can be used in any chamber designed for propane, it is suggested that it may find considerable use as a "heavy" liquid in large chambers. The time needed for bubbles to redissolve, and the difficulties implicit in the use of mixtures of liquids are discussed. (auth)

14140

HIGH-SPEED PULSE AMPLITUDE DISCRIMINATOR. F. J. M. Farley (CERN, Geneva). Rev. Sci. Instr. 29 595-6(1958) July.

A circuit for pulse-height discrimination in fast counting systems is described. Input pulses whose amplitude exceeds the threshold bias, adjustable from 1 to 21 volts, give rise to a positive output pulse of standard amplitude (6 volts), but length determined by the length of the input signal. Dead time is of order 20 mμsec and peaks 40 mμsec apart are handled independently. (auth)

14141

COMBINATION ION CHAMBER-PROPORTIONAL DOSIMETER FOR MEASURING GAMMA-RAY CONTAMINATION OF NEUTRON FIELDS. M. Slater, G. B. Bunyard, and M. L. Randolph (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 29, 601-5(1958) July.

A method for measuring low gamma-ray contamination in a fast neutron field is described by which a single detector is operated sequentially as an ionization chamber and as a proportional counter. The range of collecting voltage for which the apparent gas multiplication is independent of particle type or mode of operation was determined. The method attains high accuracy in the measurement of the ratio of neutron to total dose and has been applied to several neutron sources. (auth)

14142

MEASUREMENT OF MONOENERGETIC NEUTRON YIELDS WITH A SIMPLIFIED TELESCOPE. S. J. Bame, Jr., Eugene Haddad, J. E. Perry, Jr., and R. K. Smith (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 29, 652-3(1958) July.

In many experiments it is necessary to measure the number of high-energy neutrons from monoenergetic sources. Wide-angle counter telescopes with relatively high efficiencies have been used at neutron energies of 1 to 30 Mev. A counter telescope consists essentially of a polyethylene radiator normal to the neutron direction from the source, followed by two proportional counters, an exit aperture, and a scintillation counter. The protons from the radiator which are scattered by the neutrons in the forward direction pass through the proportional counters and stop in the scintillation crystal. The efficiency of such a system has been calculated. Neutron yield measurements made with this simplified counter telescope are in agreement with measurements made with threefold-coincidence telescopes. (A.C.)

Mesons

14143 IFA-EM-36

Academia R. P. R. Institutul de Fizică Atomică. Bucharest.

ON ANGULAR CORRELATIONS IN $\pi^+-\mu^+-e^+$ DECAYS. (Asupra Corelatiei Unghiulare in Desintegrarea $\pi^+-\mu^+-e^+$.) H. Hulubei, J. Auslănder, E. Balea, E. Friedlănder, and S. Titeica. 1958. 23p.

Facts concerning a possible lack of isotropy in the angular distribution of muons from $\pi^+-\mu^+$ decay and the question of scanning bias influence are discussed, which seem to suggest that the pion beam is polarized. These results were taken from a stack of nine electron-sensitive emulsions and imply the existence of some spatial property of the pion such as non-vanishing spin. It appears that the (μ-e) angular distribution, though $1 + \cos\theta$ under certain experimental conditions, might be of a much more complex form under other conditions. (M.H.R.)

14144 INSJ-11

Tokyo Univ. Inst. for Nuclear Study.

A MODEL FOR MULTIPLE MESON PRODUCTION IN NUCLEON-NUCLEON COLLISIONS. K. Niu. July 20, 1958. 55p.

The double lump structure of the produced mesons and the persistency of the original nucleons in high-energy nuclear interactions are found. An empirical model of multiple meson production in a nucleon-nucleon collision is constructed on these experimental bases. Assuming the summetry about the two colliding nucleons in C.M.S. the collision is divided into two parts belonging to each

nucleon. The physical quantity named "momentum of interaction" is introduced, which is the momentum difference between the initial and final state in each part. This quantity is considered to be a parameter representing the magnitude of the effect of the interaction in the collision. The average value of this quantity in high-energy jets is found to be of the order of unity in nucleon mass unit independent from incident energy. Taking as a working hypothesis an empirical relation between the "momentum of interaction" and the recoil momentum of the target nucleon in L.S. which is suggested in the analysis of one high energy jet, the details of the collision are decided in the model by the magnitude of the incident energy and that of the "momentum of interaction." This model can explain the variety of the experimental data of high-energy jets which has been accumulated up to the present. (auth)

14145 NP-6854

Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.

MEASUREMENT OF TOTAL CROSS SECTION FOR CHARGED PION PRODUCTION IN (n-p) COLLISIONS AT NEUTRON ENERGY 586 MEV. Yu. M. Kazarinov and Yu N. Simonov. 1958. 19p.

The total yield of the charged pions produced in (n-p) collisions at the effective neutron energy 586 Mev has been measured in the laboratory angle range from 15° up to 120°. The total cross section for positive and negative pion production which was found from the obtained data under the assumption of charged symmetry of nuclear forces is $\sigma(np \rightarrow \pi^+) = \sigma(np \rightarrow \pi^-) = (2.20 \pm 0.44) \times 10^{-27}$ cm^2. (auth)

14146 NP-6855

Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.

ENERGY DEPENDENCE OF THE POSITON ASYMMETRY IN MUON DECAY. A. I. Mukhin, E. B. Ozerov, and B. Pontecorvo. 1958. 19p.

The energy dependence of the asymmetry of positrons produced by polarized muon decay is investigated with a scintillation counter technique greatly suppressing the detection of Bremsstrahlung radiation. The investigation was carried out at electron energies above 20 Mev. It was found that such energy dependence agrees quantitatively with that predicted by the two-component neutrino theory. The experiments show that the polarization of the muon beam used is equal to 0.81 ± 0.11. (auth)

14147 NP-6857

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

CHARGE DISTRIBUTION OF UNSTABLE PARTICLES PRODUCED IN PION NUCLEON COLLISIONS. El. Mihul. 1958. 7p.

14148 NP-6877

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

MULTIPLE PRODUCTION OF NONSTABLE PARTICLES IN PION NUCLEON COLLISION. V. S. Barashenkov and V. M. Maltsev. 1957. 13p.

The statistical theory of multiple production of pions, nucleons, nonstable particles, and antiparticles in (π−N) collisions is considered. The deductions of the theory may be put into agreement with the experimental data if it is assumed that "strange" and "usual" particles are produced in different space volumes. (auth)

14149 NP-6881

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

ON THE INTERACTION OF STRANGE PARTICLES. Ning Hu. 1958. 8p.

The similarity between π interactions and K interactions is stressed. It is found that both interactions can be written in the universal form $H = \psi_1 \gamma_5 \phi \psi$. It is also shown that, after all symmetry requirements have been imposed, the number of independent coupling constants is six, which is less by two than that in the theory of Prentki and d'Espagnat. (auth)

14150 NP-6882

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

STRONG AND WEAK INTERACTIONS INVOLVING HYPERONS. Ning Hu. 1957. 10p.

Gell-Mann's theory of universal strong interaction is extended to include weak interactions. The result is found to be consistent with experiment. (A.C.)

14151 AEC-tr-3327

INTERACTION OF SLOW π-MESONS WITH NUCLEI. (Vzaimodeystviye Medlennykh π-Mezonov s Yadrami). A. M. Baldin and A. I. Lebedev. Translated from Zhur. Eskptl'. i Teoret. Fiz. 33, 1221-6(1957). 11p.

The influence of the interaction of charged mesons with a nucleus on the meson formation cross section is considered for the case when the meson wavelength exceeds the dimensions of the nucleus. A relationship between the meson photoproduction cross section and the shifts and widths of mesoatomic levels is obtained. Comparison with experimental data allows a series of conclusions to be made on the interaction of mesons with groups of nucleons and on the meson photoproduction mechanism. (auth)

14152

ON THE DIFFERENCE OF π^0–NUCLEON AND $\pi^\pm$–NUCLEON COUPLING CONSTANTS. Riazuddin (Imperial Coll. of Science and Tech., London). Nuclear Phys. 7, 223-4(1958) June (3).

It is shown that second-order perturbation theory indicates that the π^0-coupling constant is greater than the $\pi^\pm$-coupling constant. (A.C.)

14153

NOTES ON MESON DECAYS. R. F. Streater and J. C. Taylor (Imperial Coll. of Science and Tech., London). Nuclear Phys. 7, 276-80(1958) June (3).

Some meson decay rates are examined as closely as possible, particularly to see if they are consistent with a universal Fermi interaction of V and A type. A possible connection is noted between the pion lifetime and the bare pion mass. (auth)

14154

NOTE ON RELATIONS BETWEEN BARYON-MESON COUPLING CONSTANTS. A. Pais (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 110, 1480-1(1958) June 15.

It has been shown that the existence of certain baryon-meson coupling constant relations leads to directly verifiable connections between observables. The relations discussed state in essence that the Σ and Λ particles are coupled with the same strength, whether to π or K mesons. An investigation is made to determine whether any other relations between the constants could possibly lead to practically useful connections between the production amplitudes. (A.C.)

14155

DECAY OF K MESONS AS A TEST OF THE UNIVERSAL FERMI INTERACTION. F. Zachariasen (Stanford Univ., Calif.). Phys. Rev. 110, 1481-2(1958) June 15.

14156

DECAYS OF THE μ MESON IN THE INTERMEDIATE-MESON THEORY. G. Feinberg (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 110, 1482-3(1958) June 15.

On the basis of present experimental evidence, there is no distinction between μ mesons and electrons other than a difference in rest mass. Electromagnetic interactions are identical since electrons and μ mesons have the same charge, and the hypothesis of a universal Fermi interaction, which asserts that they couple in exactly the same way in the weak interactions, has received considerable support by comparing β-decay phenomena with the decay of free μ mesons and μ capture in nuclei. (A.C.)

Meteorology

14157 FFI/F-365

Norwegian Defence Research Establishment, Oslo.
OROGRAPHICAL AND CLIMATOLOGICAL INFLUENCES ON DEPOSITION OF NUCLEAR BOMB DEBRIS. Per B. Storebø. June 1958. 21p.

For Presentation before the Scandinavian-American Meteorological Meeting in Bergen, June 19-25, 1958.

The behavior of nuclear bomb debris in the atmosphere is reviewed in order to see how far such debris might be used as a tracer in atmospheric physics. Much debris seems to be captured by orographic precipitation, and information about the development of orographic clouds might be found by measurements of radioactivity in precipitation. Deposition of bomb debris from the stratosphere is examined by available world-wide measurements of long-lived radioactive isotopes. The simple assumption that Sr^{90} is more rapidly brought down to earth by precipitation than Cs^{137} is shown to be reasonable. This might explain British measurements of the Cs^{137}/Sr^{90}-ratio in precipitation, provided that various climatic factors are taken into account. This interpretation of the Cs^{137}/Sr^{90}-ratio together with measured total Sr^{90} deposition is in agreement with accepted latitudinal flow models for low and medium latitudes. (auth)

Microwaves

Refer also to abstract 14470.

14158 AECU-3797

Illinois. Univ., Urbana. Electrical Engineering Research Lab.
RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 TO 1000 MICRON RANGE OF THE SPECTRUM. Quarterly Progress Report No. 9 [for] March 1, 1958 to June 1, 1958. P. D. Coleman, J. R. Baird, R. C. Becker, B. W. Hakki, J. J. Stafford, R. J. Strain, and A. W. Swago. June 15, 1958. 90p. Contract AT(11-1)-392. $13.80(ph OTS); $4.80(mf OTS).

Multiplication from high, pulsed power at 3 cm was successful for second and third harmonics, and searches were made for the higher order harmonics. The gas discharge multiplier has been experimentally tried using a 3-cm pulsed source. Crystal multipliers of single-phase crossed guide types have been constructed to make use of smaller crystal mountings. A number of bolometers using 10-microinch Wollaston wire have been built into 4-mm guide components, but handling techniques are not yet sufficiently refined to prevent their eventual breakage. Theoretical computations showed the feasibility of using the open-type, dielectric, high-order cavity as a frequency meter, and two bench-test models were constructed for 4-mm wave-lengths just before the end of the interval. (For preceding period see AECU-3672.) (W.L.H.)

14159 NP-6875

Columbia Univ., New York. Columbia Radiation Lab.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM. Quarterly Progress Report No. 2 [for] March 16, 1958 through June 15, 1958. P. Kusch. June 15, 1958. 34p. Contract DA-36-039-SC-73279. (CU-1-58-SC-73279-Phys.).

A continuation of magnetron studies is reported. The status of the development of a frequency multiplier at K-band frequencies is discussed. Operation of a three level X-band solid state maser as a preamplifier in radioastronomy is discussed. The operating experience clearly indicates the value of the maser as a low noise amplifier. Research of interest in the further development of solid state masers, and in the application of the maser to spectroscopic problems is discussed. The continuing study of atomic hyperfine structures by the atomic beam technique is reported. Among the atoms under study are neon, nitrogen, mercury, tritium, and a radioactive isotope of helium. New techniques to meet the special requirements imposed in each experiment are described. (auth)

14160 NP-tr-123

PERTURBATION OF INTRINSIC FREQUENCIES OF ELECTROMAGNETIC RESONATORS BY FERRITES. Yu. (Iu.) N. Dnestrovskii. Translated by Morris D. Friedman (Lincoln Lab., MIT) from Radiotekh. i Elektron. 3, 675-89(1958). 24p.

A successive approximations method (the vector analog of the Kellogg method) is used to investigate problems of large and small perturbations of the intrinsic frequencies of electromagnetic resonators by ferrites. Convergence of the successive approximations results from the general theorems for a system of integral equations. Use of this method enables the accuracy of the results obtained in the work of other authors to be estimated. (auth)

Neutrons

Refer also to abstract 14178.

14161 AERE-T/M-124

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE SOLUTION OF THE NEUTRON TRANSPORT EQUATION BY CARLSON'S S_n METHOD. (A report of a lecture given by Dr. F. de Hoffmann at the Arnhem Conference on Reactor Calculations on April 25, 1955.) K. T. Spinney. May 1955. 9p.

14162 APAE-Memo-133

Alco Products, Inc., Schenectady, N. Y.
THERMAL NEUTRON EXTRAPOLATION DISTANCE FROM ABSORBING MEDIUM INTO BLACK CONTROL ELEMENT. Raymond L. Murray. July 15, 1958. 23p. Contract AT(30-3)-278. $3.30(ph OTS); $2.40(mf OTS).

The importance of the effect of finite absorption in the core is assessed, particularly under the conditions in which the thermal source is finite up to the rod surface. Estimates are made of the proper extrapolation distance to use with plane or large cylindrical control elements. (W.D.M.)

14163 CF-58-8-15

Oak Ridge National Lab., Tenn.

A TEST OF THE AGE THEORY (PART I). A. Sauer. Aug. 5, 1958. 12p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

The Selengut-Goertzel and the P_1-approximations to the Boltzmann equation for the neutron slowing down process in a medium of finite extent are rewritten as integral equations over Placzek functions. In this form, the equations can be solved by iteration; also, in the asymptotic case, they permit the corresponding age equations to be read off directly. The first order non-asymptotic deviations of the flux from the age theoretical expressions are calculated. (auth)

14164 WAPD-T-824

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

COMMENTS ON THE PDQ CODE. B. H. Mount. Apr. 1958. 10p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

For presentation at the Nuclear Codes Group Meeting, Los Angeles, California, June 2, 1958.

The PDQ code obtains on the IBM-704 the approximate solution to the few-group neutron-diffusion equation in two dimensions. Its specification was based on the assumption that an efficient, easy-to-use, and mathematically sound code should be created to solve the specific nuclear design problems of Bettis. (W.D.M.)

14165

ON WICK'S PROBLEM. M. V. Maslennikov (Steklov Inst. of Math., Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 120, 59-62(1958) May 1. (In Russian)

Studies were made of the thermalization and diffusion of neutrons emitted from a plane target in an infinite homogeneous isotopic media with moderator nuclear mass M (the neutron mass is considered to be unity). Parameters which do not depend on neutron energy were considered. The basic features of an accurate solution of Wick's problem (including the conclusion for assymptotic problem) are presented. (R.V.J.)

14166

EXPERIMENTAL INSTALLATION FOR IRRADIATION OF ANIMALS BY NEUTRON FLUXES (ENO-1). REPORT I. A. G. Istomina and I. B. Keirim-Markus. Med. Radiol. 3, 51-61(1958) May-June. (In Russian)

An installation was designed with a 200 curie Po+ Be mixture for experimental irradiation of laboratory animals by neutron fluxes. Estimations show that the power of the dose of gamma irradiation from the sources equals only 2.5% of the dose rate of fast neutrons. 18 such sources made of Po + Be were located in two flat cassettes in such a way as to create an uniform field of fast neutrons in the central working chamber with the dose of 1 rep per hour. Protection of the installation is made of paraffin and borax blocks. The method of study of the fast, resonance and thermal neutrons by activation of sulfur, gold, and indium specimens and the absolute measurement of induced activity is described in detail. The power of the dose of gamma-irradiation was measured by the photographic method. (tr-auth)

14167

THE AGE OF POLONIUM-BERYLLIUM NEUTRONS IN VARIOUS METAL-WATER MIXTURES. Melvin Reier, Felix Obenshain, and Robert L. Hellens (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 4, 1-11(1958) July.

The slowing-down distribution of Po–Be neutrons has been measured in aluminum–water, zirconium–water, and iron–water mixtures up to metal water ratios of 2:1 by volume. The second moment of the distribution has been obtained from these measurements and compared with theoretical calculations based on a solution of the transport equation. The effect of varying the source spectrum and cross sections in the calculations is discussed. (auth)

14168

NEUTRON AGE IN MIXTURES OF D_2O AND H_2O. James W. Wade (Savannah River Lab., Aiken, S. C.). Nuclear Sci. and Eng. 4, 12-24(1958) July.

The neutron age for fission neutrons and Po-Be neutrons was measured in mixtures of D_2O and H_2O. The age was evaluated from the second moment of the slowing-down distribution at the 1.4-ev resonance of indium. The ages of fission neutrons at concentrations of 99.8, 99.0, 98.4, 95.3, 94.0, 91.8, 48.6% D_2O, and in pure H_2O were 109, 107, 106, 93, 86, 78, 38.6, and 31 cm^2, respectively. In the range from 100 to 90% D_2O, the rate of decrease of the age was approximately 4 cm^2 for each additional per cent of H_2O. The ages of Po-Be neutrons in 99.4, 48.6% D_2O, and in H_2O were 148, 72.5, and 55.7 cm^2, respectively. (auth)

14169

ELECTROMAGNETIC STRUCTURE OF THE NEUTRON. L. I. Schiff (Stanford Univ., Calif.). Revs. Modern Phys. 30, 462-4(1958) Apr.

Experiments on the magnetic moment structure of the neutron involves its electric charge structure, since it determines the distribution of the normal magnetic moment as well as the electric charge. Forms are assumed for the electric charge and magnetic moment distributions of proton and neutron, and quantities are calculated that are related to the experimental observations on elastic and inelastic electron-deuteron scattering. (W.D.M.)

14170

NEUTRON-ELECTRON INTERACTION. Leslie L. Foldy (Case Inst. of Tech., Cleveland). Revs. Modern Phys. 30, 471-81(1958) Apr.

An electromagnetic interaction between the neutron and electron which is both spin- and velocity-independent is expected to exist if there is a separation of electrical charges in the neutron so that while neutral as a whole, it contains regions of nonvanishing charge density. There will then exist electric fields inside the neutron, and electrons penetrating this extended charge distribution will be subjected to electrostatic forces. This spin- and velocity-independent interaction is reviewed. (W.D.M.)

14171

SPACE-ENERGY DISTRIBUTION OF NEUTRONS IN A HEAVY GASEOUS MODERATOR. M. V. Kazarnovskii (Lebedev Inst. of Physics). Soviet Phys. JETP 6, 1186-7(1958) June.

The equation for the space-energy distribution of neutrons in a heavy gaseous moderator with constant mean free path and constant neutron lifetime was derived for the case of weak absorption. (J.S.R.)

Nuclear Physics

14172 TID-7016

Los Alamos Scientific Lab., N. Mex.

NUCLEAR SAFETY GUIDE. A. D. Callihan, W. J.

Ozeroff, H. C. Paxton, and C. L. Schuske. [1958]. 29p. $1.00(OTS).

Regulations for the prevention of neutron chain reaction in fissionable materials being processed, stored, or transported on an industrial scale are presented. Nuclear safety operating rules are formulated in detail, and an administrative system is set up to enforce them. (auth)

14173

REMARKS ON LEE AND YANG'S TWO-COMPONENT NEUTRINO THEORY. A. A. Sokolov. Atomnaya Energ. 4, 385-6(1958) Apr. (In Russian)

Results from the Lee-Yang two-component neutrino theory were compared with the results of the neutrino theory constructed with Dirac's equation with oriented spin. (R.V.J.)

14174

THE DIFFUSION OF HIGH-ENERGY ELECTRONS AND DISTRIBUTION OF THE ELECTRIC CHARGE OF THE NUCLEUS. Jean Reignier (Univ. of Brussels). Nuclear Phys. 7, 526-51(1958) July (2). (In French).

The phase-shift η_j of the partial wave j depends on the nuclear charge distribution only through the value at the edge of the nucleus of some function $\gamma_j(r)$, solution of a Riccati equation. Two methods to calculate this function are given. These methods are quickly convergent and provide a very precise value of $\gamma_j(r)$ after one or two iterations only. The zero order approximation (the same in both procedures) can be calculated very simply and is already quite close to the exact value. So far as this zero order approximation is concerned, the phase-shift η_j depends on the nuclear charge distribution only through the average value of some function $F_j(\kappa r)$ weighted by the nuclear charge density. The sensitivity of the differential scattering cross section to the details of the nuclear charge distribution is given. At not too high energies (less than about 100 Mev for heavy nuclei), the angular distribution of the scattered electrons depends mainly on the average values $\langle F_j(\kappa r)\rangle$. Finer details can be reached at higher energies but the static model of the nucleus becomes less founded. In the appendix, it is shown how the method may be applied to nonrelativistic nuclear scattering. (auth)

14175

COULOMB CORRECTIONS TO THE FERMI NUCLEAR MATRIX ELEMENT. William M. MacDonald (Univ. of Maryland, College Park). Phys. Rev. 110, 1420-7 (1958) June 15.

The Fermi nuclear matrix elements for positron decay between two T = 1 states can be evaluated exactly for charge-independent nuclear forces in the limit of nonrelativistic nucleon velocities to give $M_F = \sqrt{2}$. Sherr and Gerhart have used this fact to place limits on the Fierz interference terms for the scalar and vector β interactions by comparing the ft values for the O^{14}, Al^{26}, and Cl^{34} $0^+ \rightarrow 0^+$ β decays. The equality of these ft values to within an experimental uncertainty of ~10% implies a limit for the contribution of the Fierz interference term to the ft value of 12%. Such a limit will be modified by the correction terms arising from the Coulomb interaction and from v^2/c^2 terms in the nucleon velocities. These Coulomb correction terms are calculated on the coupling model with harmonic-oscillator wave functions and are shown to affect the ratio of the ft values for Cl^{34} and O^{14} by less than 1.5%. The relativistic corrections to this ratio have been shown to be even smaller. Therefore the uncertainty in the theoretical value for the square of the Fermi nuclear matrix elements is much smaller than the present experimental uncertainty in the ft values. (auth)

14176

μ-MESONIC MOLECULAR IONS AND NUCLEAR CATALYSIS. Stanley Cohen, David L. Judd, and Robert J. Riddell, Jr. (Univ. of California, Berkeley). Phys. Rev. 110, 1471-2(1958) June 15.

The experimental observation of the catalysis of nuclear reactions by μ mesons in liquid hydrogen created interest at a number of laboratories and led to several independent theoretical investigations of the processes involved. Some estimates of particular reaction rates were in wide disagreement, primarily because of the gross approximations made. In order to obtain a more satisfactory understanding of these processes, a detailed investigation has been made of the molecular systems involved in these reactions. In the investigations of the molecular ions the Born-Oppenheimer approximation is used. In this calculation, corrections to the first order in the ratio of mesonic to nucleonic mass were included. (A.C.)

14177

POSSIBLE METHOD OF INVESTIGATING GYROMAGNETIC RATIOS OF SHORT-LIVED NUCLEAR STATES WITH FAST NEUTRAL BEAMS. L. E. Beghian and R. P. Scharenberg (Massachusetts Inst. of Tech., Cambridge); and P. H. Rose (High Voltage Engineering Corp., Burlington, Mass.). Phys. Rev. 110, 1479(1958) June 15.

14178

ELECTROMAGNETIC STRUCTURE OF THE PROTON AND NEUTRON. R. Hofstadter, F. Bumiller, and M. R. Yearian (Stanford Univ., Calif.). Revs. Modern Phys. 30, 482-97(1958) Apr.

High-energy electron scattering measurements have demonstrated clearly the existence of deviations from point-nucleon scattering laws. The results obtained in the proton and neutron investigations have been interpreted as evidence of the finite sizes of the nucleons. The results already established as well as some of the most recent findings of the electron-scattering method are summarized. A brief account of the significance of the observed deviations from point-nucleon scattering is presented. (W.D.M.)

14179

WAVE EQUATION FOR A FREE NUCLEON. H. Oiglane (Inst. for Physics and Astronomy, Academy of Sciences, Estonian SSR). Soviet Phys. JETP 6, 1167-8(1958) June.

A wave equation for a free nucleon is derived. The equation can also be used to describe the doublet of the Ξ hyperons. (J.S.R.)

14180

INFLUENCE OF FINITE NUCLEAR SIZE ON EFFECTS CONNECTED WITH PARITY NONCONSERVATION IN BETA DECAY. B. V. Geshkenbein. Soviet Phys. JETP 6, 1187-8(1958) June.

14181

ONE POSSIBILITY OF BARYON CLASSIFICATION. H. Oiglane (Inst. of Physics and Astronomy, Academy of Sciences, Estonian SSR). Soviet Phys. JETP 6, 1189-90 (1958) June.

A scheme is presented for the classification of baryons which is based on their electric charge. (J.S.R.)

14182

PHENOMENON OF SPIN ECHO AND ITS APPLICATIONS. N. M. Pomerantsev. Uspekhi Fiz. Nauk 65, 87-110(1958) May. (In Russian)

The physics of spin echo is reviewed. Descriptions are given of methods for observing spin echo, of applications of spin echo in studies of relaxation processes and molecular magnetic microstructures, etc. Publications with purely mathematical approach to the spin echo problem are not discussed. (R.V.J.)

14183

SOME POSSIBILITIES OF USING POLARIZED THERMAL NEUTRONS IN RELATION TO THE NONCONSERVATION OF PARITY IN β DECAY. F. L. Shapiro. Uspekhi Fiz. Nauk 65, 133-40(1958) May. (In Russian)

Nonconservation of parity offers a basic method for the determination of polarization and the moment of a compound nucleus by measuring the angular anisotropy of β radiation emitted in the capture of polarized neutrons. The polarization measurements can also be used for determining the magnetic moments of short life nuclei produced by neutron capture. (R.V.J.)

14184

PROCEEDINGS OF THE REHOVOTH CONFERENCE ON NUCLEAR STRUCTURE HELD AT THE WEIZMANN INSTITUTE OF SCIENCE, REHOVOTH, SEPTEMBER 8-14, 1957. H. J. Lipkin, ed. Amsterdam, North-Holland Publishing Company, 1958. 629p.

Papers are included from the following sessions: shell model evidence in nuclei, the unified model, group-theoretical methods in nuclear spectroscopy, electromagnetic transitions and heavy nuclei, effects on the finite size of the nucleus, beta decay and parity, extra-nuclear effects on angular correlation, instruments of nuclear spectroscopy, and the measurement of very short nuclear life times. (M.H.R.)

14185

NUCLEAR TECHNICS: PHYSICS, TECHNOLOGY, REACTORS. PART III. Wolfgang Riezler and Wilhelm Walcher, eds. Stuttgart, B. G. Teubner Verlagsgesellschaft, 1958. pp. 321-480. (In German)

Part III continues the discussions of the special technological problems of nuclear techniques. The section on the applications of radioactive and stable isotopes is finished, and the topics of hot laboratories, radiation shielding, radiation protection, and radiation damage completes the consideration of special technological problems. The chapters on reactors are introduced with a general survey of the field. Neutron kinetics and reactor statistics are considered in the section on reactor theory. (J.S.R.)

14186

NUCLEAR TECHNICS: PHYSICS, TECHNOLOGY, REACTORS. PART IV. Wolfgang Riezler and Wilhelm Walcher, eds. Stuttgart, B. G. Teubner Verlagsgesellschaft, 1958. pp. 481-640. (In German)

Part IV continues its discussion of reactors and completes the section on reactor theory by discussing reactor statistics and fuel cycles. Reactor measuring techniques and heat problems are considered. (J.S.R.)

Nuclear Properties

14187 AEC-tr-3338

HYPERFINE STRUCTURE OF PARAMAGNETIC RESONANCE. NUCLEAR SPIN AND MAGNETIC MOMENT OF THE 5.3 – YEAR RADIOACTIVE ISOTOPE Eu^{152}. A. A. Manenkov, A. U. Prokhorov, P. S. Trukhliayev, and G. N. Yakovlev. Translated by Lydia Venters (Argonne National Lab.) from Doklady Akad. Nauk. S.S.S.R. 112, 623-5(1957). 6p.

The nuclear spin and magnetic moment of the 5.3-year radioactive isotope Eu^{152} were determined from the hyperfine structure of the paramagnetic resonance. It was found that $I(Eu^{152}) = 3$, $\mu(Eu^{152}) = 2.03$ n.m. (A.C.)

14188

COMPOSITION OF PRODUCTS FORMED BY THERMAL NEUTRON FISSION OF ^{235}U. I. COMPILATION OF NUCLEAR DATA OF THE FISSION PRODUCTS. Jan Prawitz and Jan Rydberg (Research Inst. of National Defence, Sundbyberg, Sweden). Acta Chem. Scand. 12, 369-76(1958).

An extensive compilation is made of the data up to July 1957 for the fission yields, decay schemes, half lives, and thermal neutron cross sections of the U^{235} fission products. (auth)

14189

NEUTRON SPECTRA PRODUCED ON THE PASSAGE OF 14-Mev NEUTRONS THROUGH FISSILE MATERIAL. Iu. S. Zamyatnin, I. N. Safina, E. K. Gutnikova, and N. I. Ivanova. Atomnaya Energ. 4, 337-42(1958) Apr. (In Russian)

The energy distributions of neutrons produced by the passage of 14-Mev neutrons through Th^{232}, U^{233}, U^{235}, U^{238}, and Pu^{239} were measured. The secondary neutron spectra of the investigated isotopes had two components, fission neutrons and evaporation neutrons. The dependence of coefficients of secondary neutron spectra on the nuclear constant of corresponding isotopes was determined, permitting the determination of the coefficients without experimental investigation of neutron spectra. (tr-auth)

14190

DETERMINATION OF MEAN NEUTRON EMITTED FROM THE 14.8-Mev NEUTRON FISSION OF U^{235}. A. N. Protopopov and M. B. Blinov. Atomnaya Energ. 4, 374-6(1958) Apr. (In Russian)

A double ionization chamber (with two identical layers of U^{235} on high-voltage electrodes) was used for measuring ν for 14.8-Mev neutron fission of U^{235}. Each section of the chamber was used as a detector of the initial fission and as detectors of fission neutrons in each other. The results are tabulated. (R.V.J.)

14191

THE SENSITIVITY OF THE AUTODYNE METHOD FOR THE OBSERVATION OF NUCLEAR MAGNETIC RESONANCE. Hermann Weinhold (Friedrich-Schiller-Universität, Jena, Germany). Exptl. Tech. Phys. 5, 271-80(1958). (In German)

The optimum signal-noise ratio was calculated for an autodyne model (Van der Pol oscillator) and compared with the optimum value calculated for the bridge method. The results of the high frequency cycle noise and the signal size were experimentally proved and the influences which cause a deterioration of the signal-noise ratio in autodyne detectors (e.g., the modulated NF noise) was discussed. (tr-auth)

14192

CURIUM-249. T. A. Eastwood and R. P. Schuman (Atomic Energy of Canada Ltd., Chalk River, Ont. and Knolls Atomic Power Lab., Schenectady, N. Y.). J. Inorg. & Nuclear Chem. 6, 261-2(1958) July.

The assignment of the 65 min β-activity in curium to Cm^{249} was confirmed by neutron irradiations of curium

containing 86% Cm^{248}. The half-life and maximum β-particle energy of Cm^{249} were found to be 64 ± 3 min and 0.86 ± 0.10 Mev, respectively. The yield of Cm^{249} from the irradiations corresponds to a capture cross-section of about 6 barns for Cm^{248}. (auth)

14193

NUCLEAR-CHARGE DISTRIBUTION IN FISSION: CUMULATIVE YIELDS OF SHORT-LIVED KRYPTON AND XENON ISOTOPES FROM THERMAL-NEUTRON FISSION OF ^{235}U. Arthur C. Wahl (Washington Univ., St. Louis and Los Alamos Scientific Lab., N. Mex.). J. Inorg. & Nuclear Chem. 6, 263-77(1958) July.

Experiments are described in which use was made of the very large emanating powers of barium stearate and uranyl stearate for determination of cumulative yields for a number of krypton and xenon isotopes formed in the thermal-neutron fission of U^{235}. The results, expressed as the fraction of the total chain yield, are: Kr^{89}, 0.960 ± 0.004; Kr^{90}, 0.86 ± 0.02; Kr^{91}, 0.59 ± 0.01; Kr^{92}, 0.31 ± 0.01; Xe^{139}, 0.82 ± 0.02; Xe^{140}, 0.59 ± 0.01; Xe^{141}, 0.21 ± 0.02; Xe^{143}, $(8.5 \pm 0.5) \times 10^{-3}$; Xe^{144}, $(1.1 \pm 0.1) \times 10^{-3}$. These data along with previously reported independent-yield data are used for construction of an empirical curve of the most probable primary charge (Z_p) vs. mass number. In the regions where shell edges are absent the curve is about equidistant for complementary mass numbers from the most stable charge (Z_A) lines for light and heavy fragments as proposed in the postulate of equal-charge displacement; in the regions where shell edges are present the Z_p curve makes a smooth continuous transition. The Z_p curve tends to approach and remain close to the 50-proton shell edge. (auth)

14194

THE HALF-LIFE OF ^{139}Ba. J. P. Butler and B. J. Bowles (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 6, 346(1958) July.

Samples of Ba^{139} were prepared by three different methods of irradiation, and chemically purified. A value of 82.9 ± 0.1 min was proposed for the half life. (J.R.D.)

14195

SOME PROPERTIES OF THE IRREGULAR ROTATIONAL SPECTRA IN ODD-MASS NUCLEI. Lennart Simons (Univ. of Helsinki). Nuclear Phys. 7, 209-16 (1958) June (3).

An investigation is made of the spin sequence in the rotational spectra of odd-mass nuclei for the case $K = \frac{1}{2}$. One feature of this investigation is that it leads to a method for rapidly obtaining a survey of the spin sequence in various cases. An alternative interpretation is given, as an example, of the spectrum of Tm^{171} which differs essentially from an earlier interpretation. (auth)

14196

ENERGY LEVELS IN ODD-MASS AND EVEN NUCLEI. A. de-Shalit (CERN, Geneva). Nuclear Phys. 7, 225-32 (1958) June (3).

Methods developed by Racah and first used by Talmi for the study of nuclear spectra are used to derive relations between energy level spacings in even and odd-mass nuclei in the scheme on the jj-coupling shell model. It is found that the occurrence of close lying states near the ground states of odd-mass nuclei and the absence of such states in even nuclei can be accounted for. (auth)

14197

STUDIES IN LITHIUM-7 AND NITROGEN-13. Frank R. Haig (Catholic Univ. of America, Washington). Nuclear Phys. 7, 429-42(1958) July (2).

The Pinkston-Brennan treatment of Li^6 and the Elliott treatment of N^{14} are tested by extending their assumptions to the respective three-body isotopes, Li^7 and N^{13}. The Li^7 analysis assigns a spin of 5/2 to the level at 4.61 Mev. The N^{13} analysis uses the Meshkov and Ufford tables for the expression of p^3 matrix elements in terms of p^2 elements. The phase conventions needed for the application to the $p^{-3} \rightarrow p^{-2}$ reduction are discussed. The results are favorable to Elliott's approach. (auth)

14198

RELATIVE TRANSITION PROBABILITIES IN CERTAIN EVEN NUCLEI. C. F. Coleman (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 7, 488-502(1958) July (2).

Angular correlation measurements on 2, 2, 0 cascades in Se^{76}, Ge^{72}, Zr^{92}, and Te^{122} are reported. An analysis of the available data on such cascades shows that in non-rotational even nuclei the M1 transition probability from the second to the first excited state and the E2 crossover transition probability are inhibited by factors of about 10^4 and 10^2 respectively in relation to the E2 transition probability from the second to the first excited state. For the magic nuclei Zr^{92} and Ce^{140} the corresponding factors are both less than or of the order of unity. (auth)

14199

ENERGY LEVELS OF Be^9, C^{12}, AND C^{13}. C. D. Moak, A. Galonsky, R. L. Traughber, and C. M. Jones (Oak Ridge National Lab., Tenn.). Phys. Rev. 110, 1369-74 (1958) June 15.

The reactions $Li^7(He^3,p)Be^9$, $B^{10}(He^3,p)C^{12}$, and $B^{11}(He^3,p)C^{13}$ have been used to study the level structures of Be^9, C^{12}, and C^{13}, respectively. Levels of Be^9 were observed at 1.83, 2.43, 3.1, and 4.8 Mev. Observations of the group corresponding to 1.83 Mev at different angles are consistent with the assumption of a level in Be^9 although a 3-body spectrum from $He^3 + Li^7 \rightarrow Be^8 + n + p$ could also fit the data. With the groups corresponding to the well-known C^{12} levels at 4.43, 7.65, 9.61, and 16.10 Mev used as calibrations, other levels were observed at 10.90, 11.84, 12.69, 13.30, 14.05, 14.97, 15.62, and 16.57 Mev. For the 7.65-Mev level at $\Gamma_\gamma/\Gamma_\alpha < 1.4\%$ if the level emits a single γ ray of 7.65 Mev, and $\Gamma_\gamma/\Gamma_\alpha < 0.9\%$ if there is a cascade through the 4.43-Mev state as it would if it were a 0^+ level. A proton group due to an α-particle level, predicted to lie at 5.53 Mev in C^{12}, was not found and must be more than 4000 times weaker than the proton group leading to the 4.43-Mev level. Rough estimates of $\Gamma_\gamma/\Gamma_\alpha$ for the 14.97- and 12.69-Mev levels are 50 ± 25% and 3 ± 1%, respectively. With the well-known C^{13} levels up to 6.87 Mev being used as calibrations, other levels were observed at 5.51, 6.10, 7.55, 8.87, 9.52, and 9.91 Mev. The levels at 5.51 and 6.10 Mev have not previously been detected. (auth)

14200

CENTER-OF-MASS MOTION IN THE NUCLEAR SHELL MODEL. H. J. Lipkin (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. 110, 1395-7(1958) June 15.

The methods for treating center-of-mass motion in the nuclear shell model are reviewed. The existence of

inherent difficulties of principle is pointed out for any method which attempts to remove center-of-mass effects from a shell-model wave function without considering the relation of the shell-model wave function to the Hamiltonian of the real nucleus. (auth)

14201

NUCLEAR RADII AS DETERMINED BY SCATTERING OF NEUTRONS. S. Fernbach (Univ. of California, Livermore). Revs. Modern Phys. 30, 414-18(1958) Apr.

Analyses made to determine the radius of heavy nuclei as a function of atomic weight by means of neutron scattering experiments are reviewed. Energy groupings of 40 Mev and above and below 40 Mev are considered. (W.D.M.)

14202

NUCLEAR DENSITY DISTRIBUTIONS FROM PROTON SCATTERING. A. E. Glassgold (Univ. of California, Berkeley). Revs. Modern Phys. 30, 419-23(1958) Apr.

A phenomenological approach is followed for the purpose of correlating as much of the data as possible with the assumed standard potential. This potential is not meant to give an exact description of the scattering although its form is quite plausible on physical grounds. The energies considered extend from 10 to 1000 Mev with most emphasis on the lower energies up to 300 Mev. (W.D.M.)

14203

NUCLEAR RADII FROM ALPHA-PARTICLE SCATTERING AND ALPHA-RADIOACTIVITY. John O. Rasmussen (Univ. of California, Berkeley). Revs. Modern Phys. 30, 424-9(1958) Apr.

Important measurements from inelastic and elastic cross sections for alpha particle bombardments on complex nuclei are discussed. (W.D.M.)

14204

ELECTRON SCATTERING AND NUCLEAR CHANGE DISTRIBUTIONS. D. G. Ravenhall (Univ. of Illinois, Urbana). Revs. Modern Phys. 30, 430-8(1958) Apr.

Assumptions and approximations made in the analysis of experiments on electron scattering are discussed. From the detailed shape of the differential cross section vs. angle curve, information is deduced about nuclear charge distributions. (W.D.M.)

14205

NUCLEAR RADII FROM MESONIC ATOMS. Ernest M. Henley (Univ. of Washington, Seattle). Revs. Modern Phys. 30, 438-41(1958) Apr.

The use of the μ meson as a probe to determine nuclear electromagnetic properties is discussed. (W.D.M.)

14206

NUCLEAR RADII BY LOW-ENERGY NEUTRON SCATTERING. Kamal K. Seth (Duke Univ., Durham, N. C.). Revs. Modern Phys. 30, 442-9(1958) Apr.

The determination of nuclear radii by low-energy neutron scattering is reviewed. (W.D.M.)

14207

MIRROR NUCLEI DETERMINATIONS OF NUCLEAR SIZE. O. Kofoed-Hansen (Danish Atomic Energy Commission, Risø, Denmark). Revs. Modern Phys. 30, 449-56(1958) Apr.

The differences in Coulomb energies between adjacent pairs of mirror nuclei can be interpreted as the Coulomb energy difference for homogeneously charged spheres of the appropriate charges. The resultant radius of the sphere is then a measure of the nuclear radius or more precisely the radius of the equivalent sphere. The empirical results are reviewed, and a description of the methods for interpretation is given. (W.D.M.)

14208

NUCLEAR MATTER DISTRIBUTIONS FROM COHERENT NEUTRAL PION PRODUCTION. J. E. Leiss and R. A. Schrack (National Bureau of Standards, Washington). Revs. Modern Phys. 30, 456-61(1958) Apr.

An experiment was performed to determine nuclear radii from the coherent neutral meson production. Since the π^0 production from neutrons and protons is essentially the same, what is measured is the distribution of nuclear matter as distinct from the electric charge distribution measured in electron scattering experiments. The target consisted of 7.67 g/cm^2 of carbon. The x-ray source was the bremsstrahlung beam from a 180-Mev synchrotron and was collimated to 6.4 cm diam. at the carbon target. (W.D.M.)

14209

STRUCTURE OF THE NUCLEON. J. Bernstein (Inst. for Advanced Study, Princeton, N. J.) and M. L. Goldberger (Princeton Univ., N. J.). Revs. Modern Phys. 30, 465-70(1958) Apr.

The electromagnetic field of the electron is used as a probe in investigating the structure of the nucleon because it interacts just once with the nucleon. (W.D.M.)

14210

ANGULAR SHAPES OF NUCLEI. G. M. Temmer (Carnegie Institution of Washington). Revs. Modern Phys. 30, 498-506(1958) Apr.

Departures from spherical symmetry of the nuclear charge and mass distributions are considered, i.e., the so-called angular shape of nuclei as it is revealed in various experimental situations and as it is introduced appropriately into nuclear structure theory. Since next to nothing is known at present concerning angular variations in nuclear density, it is assumed that the same radial variation exists independently of angle. The loci of constant density inside nuclei are assumed to be similar in shape to the nuclear surface. (W.D.M.)

14211

ISOTOPE SHIFT STUDIES OF NUCLEI. Peter Brix (Technische Hochschule, Darmstadt, Ger.) and Hans Kopfermann (Univ. of Heidelberg, Ger.). Revs. Modern Phys. 30, 517-20(1958) Apr.

Isotope shift studies have been evaluated for the region $36 < Z < 83$. Data for isotopic pairs with an even number of neutrons are shown. The isotope shifts provide a sensitive measure of the change of intrinsic quadrupole moments of nuclei. The data show that addition of neutrons to a nucleus changes the charge radius less than given by the $A^{\frac{1}{3}}$ law. This can be understood by assuming a nuclear compressibility. (W.D.M.)

14212

NUCLEAR SIZE ESTIMATES FROM X-RAY FINE STRUCTURE MEASUREMENTS. Robert L. Schacklett (Fresno State Coll., Calif.). Revs. Modern Phys. 30, 521-7(1958) Apr.

A brief resumé of the theoretical work on the nuclear size effect and the other associated corrections is presented in order to provide a more coherent background for description of the latest experimental measurements and the results obtainable from them. (W.D.M.)

14213

EFFECTS OF THE DISTRIBUTION OF NUCLEAR MAGNETIZATION ON HYPERFINE STRUCTURE.

J. Eisinger and V. Jaccarino (Bell Telephone Labs., Murray Hill, N. J.). Revs. Modern Phys. 30, 528-41 (1958) Apr.

The theory of the effects of the distribution of nuclear magnetization is discussed with a view to distinguishing between the various nuclear parameters that enter into the theoretical evaluation of experimental results. Such results come primarily from accurate measurement of the hyperfine interaction in which the electronic density at the nuclear position is used to probe the distribution of nuclear magnetization. Existing experimental results in the field are collected and discussed from the point of view of the single-particle model. (W.D.M.)

14214

THEORIES OF THE NUCLEAR SURFACE. Lawrence Wilets (Inst. for Advanced Study, Princeton, N. J.). Revs. Modern Phys. 30, 542-9(1958) Apr.

Surface thickness, surface energy, relative extent of protons and neutrons, and extent of nuclear forces compared with matter are discussed in terms of the different theories on nuclear surface. (W.D.M.)

14215

NUCLEAR RADII FROM ANTIPROTON MEASUREMENTS. E. Segré (Univ. of California, Berkeley). Revs. Modern Phys. 30, 550-2(1958) Apr.

The existing measurements of the antiproton cross sections are summarized, and the experiments by which they were obtained are reviewed. (W.D.M.)

14216

INTERPRETATION OF SCATTERING CROSS SECTIONS IN TERMS OF NUCLEAR SIZE. L. R. B. Elton (Battersea Coll. of Tech., London). Revs. Modern Phys. 30, 557-60(1958) Apr.

The deductions that can be made from the experimental measurements of scattering cross sections are summarized. An analysis of the assumptions is presented, and absorption cross sections at high energies are considered. (W.D.M.)

14217

RELATION OF NUCLEAR SIZE TO SATURATION AND NUCLEAR COMPRESSIBILITY. K. A. Brueckner (Univ. of Pennsylvania, Philadelphia). Revs. Modern Phys. 30, 561-5(1958) Apr.

The solution of the nuclear many-body problem is described, and the approximation method on which the solution is based is described in physical terms. No attempt is made to describe the formal theory which must be invoked to justify the plausibility arguments which are given. The saturation of nuclear matter is discussed. (W.D.M.)

14218

NUCLEAR SIZES AND THE WEISZÄCKER MASS FORMULA. Alex E. S. Green (Los Alamos Scientific Lab., N. Mex. and Florida State Univ., Tallahassee). Revs. Modern Phys. 30, 569-84(1958) Apr.

A Bethe-Weizsäcker type mass surface provides the best account of nuclear masses at a Coulomb radius parameter in agreement with the equivalent parameter inferred from Stanford electron scattering. An effort is made to relate the Weizsäcker equation directly to potentials obtained from scattering and shell models. (W.D.M.)

14219

QUADRUPOLE MOMENTS OF THE EVEN ISOTOPES OF OSMIUM AND OF LUTECIUM 175. E. E. Berlovich (Leningrad Physico-Technical Inst.). Soviet Phys. JETP 6, 1176-7(1958) June.

The half life for the first rotational level of Os^{186} was redetermined. A value of $T = (6.0 \pm 0.2) \times 10^{-10}$ sec was obtained for the half life. Taking conversion into account, a value of $(1.44 \pm 0.05) \times 10^{-9}$ sec was calculated for the radiation period. The nuclear quadrupole moment was calculated as $Q_0 = (6.4 \pm 0.1) \times 10^{-24}$ cm^2. Measurements were also made on the lifetime of the first excited state of the rotational band of Lu^{175}. No clear displacement of the $\beta\gamma$ and $\gamma\beta$ coincidence curves appeared. However, a partial lifetime of the E2 transition was found to be $\leq 1.4 \times 10^{-9}$ sec. The internal quadrupole moment for the case of E2 transitions was calculated as $Q_0 \geq 6.8 \times 10^{-24}$ cm^2. (J.S.R.)

14220

LIFETIME OF THE 264-kev LEVEL OF Er^{167}. E. E. Berlovich, K. M. Grotovskii, M. P. Bonits, and G. M. Gorodinskii (Leningrad Physico-Technical Inst.). Soviet Phys. JETP 6, 1177-8(1958) June.

The lifetime of the 264-kev level of Er^{167} was determined by investigating the coincidences between x rays accompanying K-capture in Tm^{167} and internal conversion electrons for the 57-kev transition. The half life was found to be $T_{1/2} = (2.0 \pm 0.5) \times 10^{-9}$ sec. By taking into account the mixed transition of the 57-kev transition and the conversion in all the shells, the half life of radiative decay was calculated to be $T_\gamma = 1.4 \times 10^{-8}$ sec. This gives for the partial decay periods the values $T_\gamma(E2) = 5.6 \times 10^{-8}$ sec and $T_\gamma(M1) = 1.87 \times 10^{-8}$ sec. (J.S.R.)

Nuclear Reactors

Refer also to abstracts 14439, 14442, 14445, 14446, 14447, 14450, 14451, 14456, 14458, 14459, 14460, 14463, 14464, and 14469.

14221 AECU-3792

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

FEASIBILITY STUDY OF SUPERFLUX REACTOR. J. C. Bolger, S. F. D'Urso, and R. O. Maak. Dec. 20, 1956. 21p. For Union Carbide Nuclear Co. [K-25 Plant. Contract W-7405-eng-26, Subcontract 70.] (KT-262). $4.80(ph OTS); $2.70(mf OTS).

The feasibility of a three-region aqueous homogeneous reactor designed to produce a maximum thermal flux at the center of 10^{16} n/cm^2-sec is investigated. Inner and outer regions of pure D_2O and an intermediate region of uranyl sulfate in D_2O are considered. Characteristics were calculated for the case $R_1 = 40$ cm, $R_2 = 60$ cm, and $R_3 = 150$ cm. (W.D.M.)

14222 AECU-3796

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

INSTRUMENT MANUAL FOR 1706-KER RECIRCULATION TEST FACILITY. Carl D. Swanson. June 4, 1956. Revision No. 1, Sept. 6, 1957. Contract [W-31-109-Eng-52]. 114p. (HWS-7140). $19.80(ph OTS); $6.30(mf OTS).

A functional description of the 1706 KER Recirculation Test Facility instrumentation is provided for the instrument technician. Maintenance instructions for individual instruments are not included. The manual contains a list of the instrument components in each system, a description of the system operation, and any special calibrating or operating instructions. (T.R.H.)

14223 AECU-3803
Detroit Edison Co., Detroit.
THERMAL CYCLE TEST IN SODIUM OF NINE APDA FUEL PINS. Engineering Laboratory and Research Department Report 57C05-2. J. J. Bodzin and T. A. Alessi. Feb. 12, 1958. 45p. Contract [AT(11-1)-476]. $7.80(ph OTS); $3.30(mf OTS).

The investigation undertaken to determine the effect of thermal cycling in sodium of various fuel pins has been concluded. Nine fuel pins, with various heat treatments, different end caps, and made by different manufacturers, were submitted for this test. The test consisted of the following thermal cycle: heating to 1375 ± 25°F, holding, cooling to 250 ± 25°F. The temperature of the test specimens exceeded 1200°F for at least 1 hour for each cycle. At the conclusion of the tests, the pins were examined visually to determine whether any physical damage was evident, and what dimensional and metallurgical changes had occurred. The nine fuel pins that were thermally cycled all reacted similarly. The three variables that were thought to influence pin failure, namely fuel pin fabricator, type of heat treatment, and surface preparation were found to be inconsequential in this test. (W.L.H.)

14224 AERE-T/M-113
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
CRITICAL DIMENSION OF A REACTOR WHICH REMAINS SAFE IF THE CORE IS FULLY CONTRACTED. A. Hitchcock. Oct. 1954. 7p.

A reactor with a disc-shaped core, reflected at top and bottom only, can be designed so that if the core becomes fully contracted, the increase in streaming in the newly-created gap between core and reflector balances the increase in reactivity caused by the greater density, and a supercritical configuration is not attained. Preliminary calculations of the dimensions of such a reactor are presented. It is found that there is a very sharp minimum in the investment of fissile material regarded as a function of the isotopic concentration. (auth)

14225 ANL-WHZ-373
Argonne National Lab., Lemont, Ill.
A REPORT TO THE ATOMIC ENERGY COMMISSION ON THE PROPOSED BORAX PROGRAM FOR 1954. J. R. Dietrich and J. J. Dickson. Apr. 12, 1954. Decl. Aug. 5, 1958. 24p. Contract W-31-109-eng-38. $4.80(ph OTS); $2.70(mf OTS).

Descriptions of Borax I and II are given. The proposed test program and possible hazards during the program are discussed. (W.D.M.)

14226 APAE-28
Alco Products, Inc., Schenectady, N. Y.
APPR-1 SIX MONTH OPERATING CONTRACT REPORT. H. L. Weinberg and J. K. Leslie, eds. Apr. 18, 1958. 25p. Contract AT(11-1)-318.

The plant was operated principally for crew training and power output. Some limited research and development was also performed during the period. Two cases of loss of primary water to the vapor container sump were experienced. Both of these incidents involve safety relief valves. A total of 24 unscheduled or unexplained scrams were experienced during the six months operation. Of these, 13 were chargeable to instrumentation and the remaining to various other causes. A study of the operating performance does not show any indications of inability to operate these small plants with crew sizes originally projected or even smaller. (W.L.H.)

14227 APAE-32
Alco Products, Inc., Schenectady, N. Y.
REACTOR ANALYSIS — APPR-1 CORE II. T. G. Williamson, ed. July 15, 1958. 116p. Contract AT(30-3)-278. $18.30(ph OTS); $6.00(mf OTS).

A loading of 22.38 kg of U^{235} and 33.8 g B^{10} for APPR-I Core II results in an effective multiplication of 1.023 at startup with equilibrium xenon at temperature. The control rod absorber sections contain 151 g of europium per plate contained as 38 wt. % Eu_2O_3 in a stainless steel matrix. The internal flux suppressors incorporated into the end of the control rod fuel plates are $0.020 \times 0.875 \times 2.281$ in. They contain 23.2 wt. % Eu_2O_3 in a stainless steel matrix. These will eliminate the problem of flux peaking in the control rod fuel section. (W.D.M.)

14228 APEX-393
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
CELL REMOVAL PROGRAM (704 PROGRAM DELTA). Job No. 51338. M. J. Stanley and D. S. Selengut. June 19, 1958. 20p. (XDC-58-7-75). $3.30(ph OTS); $2.40(mf OTS).

A program is described to calculate the effect on reactivity of replacing a longitudinal cell, which is a distance r from the axis of a cylindrical reactor, with a cell of different composition. The calculation is made by means of first-order perturbation theory on the basis of a two-energy-group diffusion theory. The theory and input and output data for 704 Program Delta are also described. (J.R.D.)

14229 APEX-397
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
INTERNAL FUSES FOR LOW-POWER REACTORS. T. W. Donaven, S. N. Stilwell, and J. G. Stuart. Oct. 1953. 17p. Contracts AF33(038)-21102 and AT(11-1)-171. $0.75(OTS).

Research is described in the development of internal fuses for low power reactors. Only the type which uses nuclear energy to trigger an auxiliary energy source to complete its action was considered. It was concluded that a shaped charged in a cavity lined with poison material could be used in fast reactors. (T.R.H.)

14230 BAW-1047
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
A REVIEW AND EVALUATION OF MAINTENANCE CONCEPTS FOR LIQUID METAL FUEL REACTORS. J. J. Happell, ed. Mar. 1958. 122p. Contract AT(30-1)-1940. $3.00(OTS).

Maintenance concepts for large-scale externally cooled liquid metal fuel reactors have been conceived and evaluated with respect to methods and expected costs. Of seven conceptual maintenance schemes, two have been selected as the most promising for current study and future development. This evaluation discusses both concepts as they apply to single-region and two-region LMFR plants generating 825 Mw of heat and 315 Mw of electricity. A comparison of the expected maintenance costs, total power costs, and annual outage times for 315-Mw(e) LMFR plants is given. (W.D.M.)

14231 CENC-1005
Combustion Engineering, Inc. Nuclear Components Engineering Dept., Chattanooga.
DEVELOPMENT OF WELDED SEAL FOR S3G REACTOR VESSEL. J. W. Rogers. Jan. 1958. 74p. CE Contract No. 22655-OB1A. $13.80(ph OTS); $4.80 (mf OTS).

The development program consisted of preliminary design, welding accessibility and feasibility, pressure and displacement cycling, theoretical analysis and life computation, photoelastic analysis, and comparison of PWR straight sample cycling. Design "C" of the three primary designs considered proved more satisfactory from a fatigue life standpoint. (W.D.M.)

14232 CF-57-8-15

Oak Ridge School of Reactor Technology, Tenn.

200 MW NUCLEAR POWER STATION USING A NATURAL URANIUM, ORGANIC COOLED, HEAVY WATER MODERATED, HETEROGENEOUS POWER REACTOR. A. F. Veras, F. S. Beal, G. L. Hartfield, H. D. Irwin, E. A. Licitra, H. I. Lill, Jr., H. McNeill, C. B. Magee, W. J. Roesener, and K. A. Wheeler. Aug. 1957. 255p. $39.60(ph OTS); $11.10(mf OTS).

A preliminary design and feasibility study is presented for an organic cooled, heavy water moderated, natural uranium fuel, heterogeneous reactor for a central station power plant with an electrical capability of 200 Mw. This study indicates that such a plant is capable of producing electrical energy in the range of 6 to 7 mills/kwh with burnups of the order of 3000 Mwd/ton. The use of organic coolants permits high temperature operation at low pressure and thereby eliminates the necessity for thick-walled, expensive reactor components. Compatability of the organic coolant with uranium dioxide and aluminum together with the low pressure features of the system allows the use of inexpensive fuel elements. (auth)

14233 CF-57-12-69

Oak Ridge National Lab., Tenn.

FISSION PRODUCT DIFFUSION THROUGH CLAD CERMET FUEL ELEMENTS. L. P. Crocker and C. E. Creek. Dec. 16, 1957. 7p. Contract [W-7405-eng-26]. $1.80 ph OTS ; $1.80(mf OTS).

Small plates of UO_2 clad with 5 mils of 304L stainless steel were irradiated, cooled, and placed in an experimental apparatus at high temperature swept out by N_2 gas. No increase in activity was observed, indicating that no diffusion through the clad took place. These results disagree with those of previous experiments, however, and must be considered inconclusive. (T.R.H.)

14234 CF-57-12-145

Oak Ridge National Lab., Tenn.

SURVEY OF PROCESSES FOR CONTROL OF Xe-135 POISONING IN HRE-3. E. A. Mason. Dec. 23, 1957. 44p. Contract [W-7405-eng-26]. $7.80(ph OTS); $3.30(mf OTS).

Various systems for reducing the effect of poisoning by Xe^{135} in HRE-3 have been evaluated. Considering the design criteria that the reactor shall not be dependent on operation of auxiliary equipment, xenon removal by means of direct let-down of either vapor or fuel solution was eliminated. Processing of condensate produced in the high pressure system for removal of iodine appears presently to be tne most satisfactory method. Processing of 1.5 gallons per minute of condensate should result in reduction of xenon poison fraction to about 1%. The proposed system combines condensate production and prevention of xenon poisoning so that the need for let-down and pump-up between high and low pressures is reduced and the over-all reactor design is thereby simplified. (auth)

14235 CF-58-4-75

Oak Ridge National Lab., Tenn.

A CALCULATION OF THE ENERGY SPECTRUM AND ANGULAR DISTRIBUTION OF GAMMA RAYS AT THE SURFACE OF THE BSF REACTOR. L. A. Bowman, W. W. Dunn, R. H. Lessig, and D. K. Trubey. Apr. 15, 1958. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The energy and angular distributions of the gamma rays leaking from the BSF reactor were computed by integrating the sources over the entire reactor and applying an attenuation kernel. The primary gamma-ray spectrum was grouped into six initial energy groups, E_0, of 0.5, 1, 2, 4, 6, and 8 Mev. The uncollided flux in each energy group at a point on the center of the north face was computed as a function of direction given by θ and ϕ. The collided flux was determined for each initial energy group by including the term $[B(\mu R)-1]$, where $B(\mu R)$ is the energy buildup factor, in the initial integrand and was divided into contributions to that particular energy group and each lower energy group by assuming that the collided flux had a differential energy spectrum of the type computed for a point source after passage through 1 mfp of water. The total gamma-ray spectrum compared favorably with previously calculated spectrum, but was in the usual disagreement with experimental results. The angular distribution was determined by assuming the collided and uncollided flux had the same angular distribution. (auth)

14236 CWR-400-2

Curtiss-Wright Corp. Research Div., Quehanna, Penna.

HAZARDS EVALUATION REPORT, CURTISS-WRIGHT RESEARCH REACTOR. Dec. 16, 1957. 123p.

The experimental program for which the 1000-kw swimming pool reactor is to be utilized will include shielding studies, reactor component and instrument development, investigations of radiation damage, and neutron physics. In addition, the reactor will be used for radioisotope production, activation analysis, and training purposes. Supporting facilities and the site are described in detail. Operational procedures and safety devices are considered. (W.D.M.)

14237 DTMB-1128

David W. Taylor Model Basin. Applied Mathematics Lab., Carderock, Md.

TWO-DIMENSIONAL REACTOR SIMULATOR CODE FOR UNIVAC INSTRUCTION MANUAL. Ruth M. Davis, Maxine H. Jackson, and Elizabeth Cuthill. July 1956. 116p.

Reprint of Applied Mathematics Lab. Technical Report 18.

The first part of the code input includes a description of the geometric distribution of materials in the reactor and the necessary physical constants such as diffusion coefficients, absorption cross sections, fission cross sections, scattering cross sections, and the like. The form of the data is described. The second part of the input is an initial guess for the flux. The restrictions imposed by the code, remarks and instructions for operators, tape chronology for normal running, the control tape, description of individual runs, and the modification necessary to include the three group reactor simulator problem are included. (M.H.R.)

14238 FZM-1707

Convair, Fort Worth, Tex.

FISSION PRODUCT FIELD RELEASE TESTS—EXPERIMENT DESIGN. June 6, 1958. 65p.

The current status of planning of tests proposed to determine the behavior of selected fission products released to the atmosphere under conditions simulating nuclear aircraft melt down is presented. The plan includes two series of experiments: in the first series, HTRE-type elements containing long-lived isotopes,

chief among which is Cs^{137}, will be used, and in the second series, freshly irradiated HTRE-type elements containing I^{131} and Xe^{133} will be used. These fission products are to be released at ground level by induction melting, under 3 lapse conditions, and 3 inversion conditions, along with release of fluorescent tracer and smoke. The ground activity will be measured, and smoke plume movement will be photographed. (J.R.D.)

14239 GEAP-2095

General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.

PROCESS DEVELOPMENT — DRESDEN BORON STAINLESS CONTROL RODS. J. W. Weyers, W. R. Smith, and D. A. Venier. Apr. 25, 1958. 19p.

The fabrication and mechanical testing of boron stainless steel poison control rods are described. The various facets of material and process development required and the mechanical, metallurgical, and dimensional test results are described. It is pointed out that the material can be formed, fusion welded, and resistance welded to close tolerances with up to 2 ± 0.15% boron. (J.R.D.)

14240 HW-46679(Rev.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

REACTIVITY CHANGES RESULTING FROM VARIATION OF MODERATOR QUALITY IN THE PRPR. M. V. Davis. [n.d.] 11p. Contract [W-31-109-Eng-52.] $3.30(ph OTS); $2.40(mf OTS).

The effects of adding light water to the PRPR are discussed for two different fuel loadings. The first case is for natural uranium oxide at 90% theoretical density. The second case is for uranium uniformly enriched by 12 kg Pu. (W.D.M.)

14241 HW-52461

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

APPLICATION OF THE ALUMINUM–CRYOLITE REDUCTION PROCESS TO THE PLUTONIUM RECYCLE PROGRAM. Ward L. Lyon. Sept. 12, 1957. 10p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80 (mf OTS).

The reduction of plutonium oxide with aluminum using a cryolite flux should find application in the preparation of plutonium–aluminum spike fuel material for the Plutonium Recycle Program. Losses encountered in the batch reduction process are low (ca. 0.2 percent), and over-all costs should compare quite favorably with the alternative method which requires plutonium metal. Preparation of a master alloy, followed by dilution with aluminum or aluminum-silicon during remelting and casting, is a recommended procedure. The process has been successfully demonstrated on a semi-continuous basis, wherein additions of aluminum and oxide and withdrawals of alloy product and waste cryolite were made, with the reaction crucible held continuously at 1050 to 1080°C. A semi-continuous cell, wherein the by-product aluminum oxide is reduced electrolytically appears to be a means of circumventing the disposal or recovery of spent cryolite. Further development of this technique would seem to be warranted. (auth)

14242 HW-54074

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A GENERALIZED CALCULATION OF MATERIAL AND REACTIVITY BALANCE IN RECYCLED PLUTONIUM REACTORS. R. E. Peterson and G. S. Busselman. Jan. 27, 1958. 35p. Contract W-31-109-Eng-52. $1.00(OTS).

A generalized formulation of material and reactivity balance in plutonium recycle systems has been developed and coded for the IBM-650 computer. Steady state operation and linearly graded irradiation are assumed. Isotope concentration equations have been linearized through the use of effective reactor cross sections. Examples are given to illustrate application of the calculation. (auth)

14243 HW-54727(Rev.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A PARAMETRIC STUDY OF THE GAS-COOLED REACTOR CONCEPT. Mar. 1, 1958. 41p. Contract W-31-109-Eng-52. $1.25(OTS).

A summary of the parametric study results, the selection of the reactor concept for further analysis in Phase III of the HAPO study program, a discussion of the parametric study, and a review of areas of process technology requiring additional study and development are presented. Rough cost estimates of 8 mils/kwh when using private financing rates of 15% capital charges per year and a by-product plutonium value of $12/g resulted in a number of cases considered. (W.D.M.)

14244 HW-56914-A2

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PLUTONIUM RECYCLE PROGRAM MONTHLY REPORT [FOR] JULY 1958. F. W. Albaugh, L. P. Bupp, P. F. Gast, and W. H. Reas. Aug. 15, 1958. 15p. Contract W-31-109-eng-52. $3.30(ph OTS); $2.40(mf OTS).

Fuel development progress is briefly reported. Research projects are described, and data are given on swaged density of arc fused UO_2. Studies on thermal hydraulics and mechanical equipment and design development in connection with the Plutonium Recycle Test Reactor are also described. (For preceding period see HW-56640-A2.) (T.R.H.)

14245 IDO-16342

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

SUBCOOLED TRANSIENT TESTS IN THE SPERT I REACTOR — EXPERIMENTAL DATA. J. C. Haire. July 1, 1958. 187p. Contract AT(10-1)-205. $3.00 (OTS).

Detailed experimental data are presented for each test of a series performed in the Spert I reactor. These tests consisted of instantaneous insertions of excess reactivity at an initial reactor temperature of approximately 20°C. The results have been presented in "Experimental Study of Transient Behavior in a Subcooled, Water-Moderated Reactor," Nuclear Science and Engineering, 2, 96-115 (1957), F. Schroeder, S. G. Forbes, W. E. Nyer, F. L. Bentzen and G. O. Bright. The present report provides a more complete documentation of the experimental data from the tests. The test procedure is briefly discussed. The data obtained are analyzed as to the nature and magnitude of errors involved and presented in a series of individual test data figures. These figures illustrate reactor power, fuel plate surface temperature and pressure as functions of time. A composite figure displaying reactor power, as a function of time for representative tests of all periods, is included as are similar composite figures illustrating fuel plate temperature and pressure. Correlated data figures displaying measured test data as functions of reactor

period are included along with a tabulation of all measurements. The list of references includes a brief description of the nature and contents of the publications which may be used to supplement this report. (auth)

14246 IDO-16435(Suppl. I)
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
ENGINEERING TEST REACTOR CRITICAL FACILITY HAZARDS SUMMARY REPORT. Supplement I. D. R. deBoisblanc, E. E. Burdick, and T. K. DeBoer. Jan. 24, 1958. 16p. Contract AT(10-1)-205. $0.75(OTS).

Measurements in the Engineering Test Reactor Critical Facility in connection with safety hazards involved in some proposed experiments are presented. (T.R.H.)

14247 KAPL-1757
Knolls Atomic Power Lab., Schenectady, N. Y.
THE FAST OXIDE BREEDER—THE FUEL CYCLE. J. K. Davidson, W. O. Haas, Jr., J. L. Mewherter, R. S. Miller, and D. J. Smith. July 1, 1957. 98p. Contract W-31-109-Eng-52. $2.25(OTS).

The development of a fast breeder fuel cycle based on a core fuel consisting of mixed dioxides of uranium and plutonium is described. Process flowsheets, material balances, operating schedules, cost schedules, and a plant layout are presented, and the laboratory- and plant-scale process and equipment demonstrations are described. A cost estimate based on a demonstration of the process including the unique plant equipment gives a total fuel cycle cost of 2.04 mils/kw-hr and a net fuel cycle cost of 1.53 mils/kw-hr (0.3 breeding gain assumed). (auth)

14248 NARF-58-32T
Convair, Fort Worth, Tex.
EQUIPMENT MODIFICATIONS FOR THE ASTR-TSF EXPERIMENT. B. A. Kress. July 28, 1958. 41p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-210).

The modifications made to the Aircraft Shield Test Reactor (ASTR) and to its auxiliary equipment and new equipment fabricated specifically to meet the requirements of the experimental program at the Oak Ridge Tower Shielding Facility (TSF) are described. The experiments with the ASTR at the TSF entailed hoisting equipment to various heights up to 186 feet. For the experiments, extensive changes in the reactor shell, the reactor control system, the coolant and shield water system, and in ground support equipment were necessary. In addition, suspension systems for the reactor and crew compartment had to be devised and constructed. (auth)

14249 NDA-84-8
Nuclear Development Corp. of America, White Plains, N. Y.
ENGINEERING DESIGN OF 10 MWe SDR; STATUS REPORT AS OF APRIL 30, 1958. A. Stathoplos. July 31, 1958. 33p. SDR Project. Contract AT(30-3)-256. $6.30(ph OTS); $3.00(mf OTS).

Preliminary design of a 10 Mwe sodium deuterium reactor (SDR) is presently in progress at NDA. Design features of the reactor, which is sodium cooled and D_2O moderated, are described, and the results of several experimental testing programs designed to establish the feasibility of sodium—heavy water separation are summarized. (auth)

14250 NDA-3002-1
Nuclear Development Corp. of America, White Plains, N. Y.
PAWLING RESEARCH REACTOR HAZARDS SUMMARY REPORT. A. Stathoplos and E. L. Zimmerman. Feb. 28, 1958. 43p. $7.80(ph OTS); $3.30(mf OTS).

The Pawling Research Reactor, a 5-watt heavy-water moderated and reflected reactor, is described. The hazards associated with its operation are discussed. (T.R.H.)

14251 NMI-4401
Nuclear Metals, Inc., Cambridge, Mass.
PRDC MELT-DOWN TEST. Progress Report for the Period August 1956 through January 1957. J. J. Pickett, A. R. Kaufmann, H. F. Sawyer, and J. E. Roman, Jr. Apr. 16, 1957. 33p. $6.30(ph OTS); $3.00(mf OTS).

Of the tests performed on the melt-down program, the major portion of the work has been concentrated on single pin melt-down of uranium—molybdenum core fuel pins 0.158 inch diameter × 15 inches long, clad with 0.004 inch of zirconium. Results from these tests indicate that no correlation can be readily made between temperature and the time of molten core containment. At 1200°C the time has varied from 1.75 min to 21 min. Preliminary tests indicate that contact with stainless steel wire considerably reduces the life of a pin element. Progress in fluidity testing has been limited primarily to evaluation of the apparatus and test equipment; a spiral mold has been chosen as the best shape for fluidity determination. (auth)

14252 NMI-4402
Nuclear Metals, Inc., Cambridge, Mass.
PRDC MELT-DOWN TESTS. PROGRESS REPORT ON SINGLE-PIN MELT-DOWN TESTS FOR PRDC DURING THE PERIOD FEBRUARY 1957 THROUGH JUNE 1957. J. J. Pickett, A. R. Kaufmann, and J. E. Roman, Jr. Jan. 16, 1958. 42p. Contract [AT(11-1)-476]. $6.30 (ph OTS); $3.00(mf OTS).

This program has indicated that the time that a thin Zr cladding can contain the molten U—Mo core alloys can vary over a considerably wide range and is a function of the original cladding condition. Small surface imperfections which now are either overlooked or disregarded, as well as internal defects which are not now found appear to be principal causes of premature failure. Also demonstrated in this program is the fact that serious defects can be produced in what is believed to be sound cladding by touching the cladding with stainless steel at high temperature (>1100°C). (W.L.H.)

14253 NRDC-35
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
FAST NEUTRON PROCESSES IN Be. J. E. Sanders and D. J. Littler. Mar. 1954. 4p.

The (n,α) and (n,2n) reactions on Be^9 are discussed with reference to the use of this material as a moderator for reactors. As the effect of these processes on the k of a beryllium-moderated system may be of considerable importance, suggestions for further experimental work are made. (auth)

14254 ORNL-2405
Oak Ridge National Lab., Tenn.
REACTOR CONTROLS ANALOG FACILITY (RCAF) OPERATIONS MANUAL. F. P. Green. Aug. 20, 1958. 71p. Contract W-7405-eng-26. $2.00(OTS).

A description of the Reactor Controls Analog Facility is given. The theory, operation, and simulation system are discussed. (W.D.M.)

14255 ORNL-2470
Oak Ridge National Lab., Tenn.
SAFEGUARD REPORT FOR A STAINLESS STEEL RESEARCH REACTOR FOR THE BSF (BSR-II). E. G.

Silver and J. Lewin. Aug. 11, 1958. 103p. Contract W-7405-eng-26. $2.50(OTS).

An additional reactor, designated as the BSR-II, is proposed for the ORNL Bulk Shielding Facility. A description of the mechanical features and the dimensions of the reactor, the nuclear and heat transfer characteristics as calculated, and a discussion of the proposed control system, including the results of experimental investigations of the proposed control system and its dynamic behavior, are presented. (W.D.M.)

14256 ORNL-2493
Oak Ridge National Lab., Tenn.
HOMOGENEOUS REACTOR PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JANUARY 31, 1958. Aug. 7, 1958. 216p. Contract W-7405-eng-26. $3.50(OTS).

Homogeneous Reactor Test. Following the HRT tests with light water and depleted U, the piping was leak-tested by pressurizing to 500 psig with nitrogen containing 40 curies of Kr^{85}. The adsorption capacity of two charcoal beds was tested and found satisfactory, completing the experiments on the off-gas system. Fuel injection began on December 24; in the afternoon of December 27, the reactor began chain-reacting at 29°C with a mass of 2060 g. Seven criticality experiments were conducted with the fuel thimble removed and with the source in the blanket thimble. The carbon steel transition strips between the galvanized iron roof seal pans and the containment cell walls were replaced by type 347 stainless steel transition strips. The design of facilities for the removal and replacement of the core and blanket corrosion sample holders and the pressure balancing system rupture disk assembly was completed. Test results are given on two pumps that circulated 0.04m UO_2SO_4 for 1585 and 5040 hr. Various surface treatments have had no significant effect on the endurance limit of type 347 stainless steel exposed to UO_2SO_4 as compared with the performance of sheet given a standard ASTM No. 9 finish. The HRT mockup completed a 2210-hr run at 1700 psi and 280°C. The generalized corrosion rate was 1.3 mpy. A second silver-plated wire-mesh bed, having a density of 29 lb/ft^3, was tested for iodine removal efficiency, which was found to be 99.8% at 120°C. Electric-signal differential-pressure transmitters were tested and were installed in the leak-detection system. Spurious radiation signals were eliminated from two fission chamber channels by running the coaxial signal cables in a plastic tube and by grounding the amplifier rack directly to the thimbles. Leak rates from the piping system of the processing plant were acceptably low after one leak in an instrument pressure tap had been repaired. The cell closure of the processing plant was completed with the welding of seal pans between two top roof plugs. The times required for Kr^{85} tracer activity to break through the charcoal beds were determined. Reactor Design, Research and Analysis. The effect of the value η^{25} in the resonance region upon the breeding ratio in thorium breeder reactors was studied by means of multigroup calculations. Time-dependent studies of slurry-core, slurry-blanket thorium breeder reactors generating about 60 thermal megawatts indicate that the core poison fraction is the major variable affecting the breeding ratio. Revised calculations were performed to determine the heat generation rates in the HRE-3 core vessel. Digestion of freshly precipitated thorium oxalate before filtration and firing resulted in thorium oxide particles which were resistant to degradation. Laminar heat transfer measurements with aqueous ThO_2 slurries indicate that the corresponding heat transfer coefficients are greater than the conventional Newtonian fluid coefficients. Engineering Development. The reconstructed high-pressure recombiner loop was operated for 500 hr at 600 psi and temperatures of 500°C before failure of welds in the boiler caused termination. Specimens of crystal bar Zr disintegrated in the super-heated vapor, while Zircaloy-2 was not attacked. Palladium and tungsten carbide flame-coated on type 347 stainless steel, 355 stainless steel, and gold dump-valve trims were tested. Test pieces of Ti-lined 3½-in. and 20-in. carbon steel pipe suffered weld failures during hydrostatic testing. An all-titanium letdown heat exchanger was constructed for the HRT mockup. Boiling HRT fuel solution has had no deleterious effects on a titanium container after 1200 hr at 1500 psi and 313°C. Check-valve seats of type 347 stainless steel and Stellite No. 1 and balls of Stellite Star failed quickly in 200 g of Th per liter, 1600°C-fired slurry. Design and fabrication of a 30-in. model of the HRE-3 blanket were initiated. Slurry and water were circulated in the 100- and 200-gpm loops for more than 4103 hr. A thrust bearing designed for the 100A pump operated satisfactorily on water but failed during a test with 1200°C-fired spheres of ThO_2. Seven runs were made in the 100-gpm loops to determine the effects of additives on the caking and sphere-forming tendencies of 800°C-fired oxide. Blanket run SM-4 terminated on schedule after 2400 hr of operation. Results of tests on valve materials are presented. Reactor Materials Research. The corrosion rate of carbon steel in boiler water containing various concentrations of O_2 has been determined. The corrosion resistance of a number of alloys was determined in 0.17m UO_2SO_4. Stress-corrosion specimens tested in boiling water containing 25 to 500 ppm Cl^- have not shown evidence of cracking after 3000 hr. All the austenitic stainless steels tested, except 309 SCb, developed cracks in chloride containing water in less than 300 hr at 300°C. Type 347 stainless steel, Zircaloy-3A, and titanium 75A exhibited moderate attack rates in tests with oxygenated slurries of ThO_2. Results are given of corrosion–erosion attack by ThO_2 prepared by various means. The corrosion rates of Zircaloy-2 and type 347 stainless in in-pile loop tests are presented. The quench-and-reheat transformation data obtained on the ternary Zr–Nb–X and on the binary Zr–Nb alloys are presented. Chemical Engineering Development. Adsorption of iodine from a flowing gas stream by charcoal appeared irreversible, but a very slow movement on a bed of molecular-sieve material was noted. In UO_2SO_4 blanket processing the results of four runs with Pu in 1.4m UO_2SO_4 at 250°C under 350 to 400 psi of O_2 in the P-1 loop were similar to those obtained previously with Zr. Plutonium adsorption on stainless steel from 1.4m UO_2SO_4 is described. The irradiation of 1600°C-fired ThO_2 in D_2O is presented. Supporting Chemical Research. The rates of the Cu-catalyzed deuterium–oxygen reactions were measured in heavy-water solutions. Analytical Chemistry. A sensitive spectrophotometric method was devised for the determination of Ti in slurries of ThO_2. A polarographic method was applied to the determination of microgram quantities of U in samples of ThO_2 slurry. A procedure was devised for the flame-photometric determination of microgram quantities of Ag in UO_2SO_4 solutions. A pyrolytic separation method for the removal of Ru from materials is presented. (For preceding period see ORNL-2432.) (W.L.H.)

14257 ORNL-2553
Oak Ridge National Lab., Tenn.
THE EFFECT OF EPITHERMAL FISSION ON AQUEOUS HOMOGENEOUS REACTORS. Shoichi Terasawa. Aug. 20, 1958. 19p. Contract W-7405-eng-26. $0.75 (OTS).

In light-water-moderated reactors epithermal fissions become important as the concentration of fissionable material increases. The magnitude of the effect for U^{235} and U^{233} light-water-moderated reactors was estimated using a very simple model and values of numerical integrations of BNL-325 cross sections. (auth)

14258 TID-3068
Technical Information Service Extension, AEC.
THE SHIPPINGPORT PRESSURIZED WATER REACTOR. A Bibliography of Unclassified Report Literature. Sidney F. Lanier, comp. Feb. 1958. 44p. $1.25(OTS).

A total of 193 annotated references to unclassified reports on the design, development, and construction of the Shippingport Pressurized Water Reactor is presented. Author, subject, and report number indexes are included. (auth)

14259 TID-3073
Technical Information Service Extension, AEC.
REACTOR SAFETY. A Selective Bibliography. Richard J. Smith, comp. May 1958. 80p. $2.25(OTS).

Total of 440 annotated references to unclassified reports and the published literature is presented on reactor systems, materials, and operation designed to provide maximum safety for the reactor, reactor personnel, and environs. Information is included concerning incidents and conditions of operation considered hazardous. Author, subject, and report number indexes are provided. (auth)

14260 WAPD-CTA(EMA)-322
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
EVALUATION OF METHODS FOR IMPROVING MOTOR TUBE RESISTANCE TO STRESS CORROSION. [Feb. 1958]. 21p. $4.80(ph OTS); $2.70(mf OTS).

Corrosion testing of AISI hardened 410 stainless steel control rod drive mechanism motor tubes indicated that design stresses might not be achieved. The results of evaluation of several corrective design steps are given. (T.R.H.)

14261 WAPD-EM-211
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
STABILITY STUDY OF PWR. H. Estrada, Jr. July 28, 1954. Decl. Aug. 4, 1958. 85p. $13.80(ph OTS); $4.80(mf OTS).

The design of the PWR plant is analyzed for stability with a control system based on a constant average coolant temperature. Results indicate that in order to maintain steam pressure within reasonable limits, stringent control of average temperature must be maintained, and widening of the ± 3°F dead band would have to be considerable before these requirements could be relaxed. The low pass band for the system portends a slow response control system regardless of gain. Temperature coefficient and thermometer time constant have a large effect on plant stability, but placement of the temperature-sensing element in the pressure vessel is not significant. The analysis indicates that the homogeneous chemical control and rod control have many of the same problems. (J.R.D.)

14262 WAPD-PWR-(RD2)-147
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh].
EVALUATION OF SUPPLEMENTAL STUDIES OF CORE 1 FLOW DISTRIBUTION IN A QUARTER-SCALE MODEL OF THE PWR REACTOR. F. A. Grochowski. [Jan. 1958]. 2p. $1.80(ph OTS); $1.80(mf OTS).

This report supplements information contained in BMI-1229.

A study of flow distribution throughout a quarter-scale model of the pressure vessel and simulated internal components of the PWR reactor is presented. The results of these tests showed a definite need for a flow baffle in order to limit the flow variations in the core to within the allowed ±7% during asymmetrical 3-loop flow and during either 2-adjacent or 2-opposed-loop operation. (W.L.H.)

14263 WAPD-TM-120
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
TWO-REGION EXPERIMENTS IN SLIGHTLY ENRICHED WATER-MODERATED URANIUM AND URANIUM DIOXIDE LATTICES. G. G. Smith, J. J. Volpe, D. Klein, F. S. Frantz, and J. C. Andrews. Mar. 1958. 22p. Contract AT-11-1-GEN-14. $0.75(OTS).

The two-region critical configuration contained a subregion of uranium dioxide fuel, 0.384 in. in diameter, arranged in a hexagonal lattice to give a water-to-uranium volume ratio of 4.9. This subregion was surrounded by a lattice containing uranium metal rods, 0.387 in. in diameter with a water-to-uranium volume ratio of 2.35. Both fuels were enriched to 1.3 wt. % U^{235}. Radial neutron flux distributions were calculated by means of a one-dimensional, few-group diffusion equation code for two different subregions. Measurements of the thermal utilization, resonance escape probability, and fast fission factors have been made. (W.D.M.)

14264 WASH-169
Weather Bureau, Washington, D. C.
REVIEW OF REACTOR EXCLUSION RADIUS FORMULAS. J. Z. Holland. Feb. 16, 1954. Decl. June 26, 1958. 30p. $4.80(ph OTS); $2.70(mf OTS).

In making estimates of the outer radius of serious hazards resulting from accidental airborne dispersion of the radioactivity generated in a reactor, some assumptions are made as to the quantity of radioactivity discharged, the meteorological conditions determining the rate of dispersion in route, and the limiting exposures determining the "exclusion radius." Marley's assumptions and results are compared with those of the exclusion radius formulas in use by the AEC Advisory Committee on Reactor Safeguards. (W.D.M.)

14265 YAEC-71
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
FISSION AND CORROSION PRODUCT ACTIVITIES IN MAIN COOLANT AND ATMOSPHERE OF THE VAPOR CONTAINER. H. S. Kresny and P. B. Haga. May 15, 1958. 41p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $7.80(ph OTS); $3.30(mf OTS).

Fission products, which may leak from the fuel and activated corrosion products from stainless steel surfaces, influence the design of several systems which support the main coolant system. Since the radioactivity in the main coolant resulting from these impurities must be limited to reasonable levels during operation, a purification system becomes important. Air conditioning of the vapor container as a result of possible main coolant leakage may be necessary during and after operation to remove airborne activity. After shutdown, treatment and disposal of active effluents becomes the

function of a waste disposal system. Activities are tabulated, by individual isotopes, for 10,000 hours of full power operation. (auth)

14266

SAFE STARTUP OF ZERO-REACTORS. B. G. Dubovskii. Atomnaya Energ. 4, 365-6(1958) Apr. (In Russian)

A method of safe startup for zero energy reactors is described. An Sb–Be source is inserted into the reactor, forming a photo-neutron source of 4×10^7 n/sec. The implantation of the source into the reactor reduced the uncontrolled interval by increasing the power about 5×10^5 times. The method assures the permissible increase of reactor power by the gradual and uniform (stage or continuous) extraction of boron rod from equivalently effective areas. A table indicates that after six extractions the power of the reactor increased 5×10^5 times (with $\Delta k = 31.5 \times 10^{-4} = 0.31\%$) thus reaching the controlled level. (R.V.J.)

14267

THE USE OF A DIRECT FLOW CYCLE IN A BOILING-WATER REACTOR. Yu. N. Alekseenko. Atomnaya Energ. 4, 366-7(1958) Apr. (In Russian)

A boiling reactor with direct flow cycle was studied to determine the nature of neutron density drop in the upper section of the reactor and to find the coefficient of irregular heat exchange along the active zone. (R.V.J.)

14268

THE SECONDARY LOOP IN A BOILING-WATER REACTOR. Yu. D. Arsen'ev. Atomnaya Energ. 4, 367-70 (1958) Apr. (In Russian)

The design and performance of secondary loops with heat exchangers and self-evaporators were analyzed. It was found that the scheme with a self-evaporator simplifies construction and is more efficient in spite of the required excess power for its operation and the differential on circulation pumps. Lower temperatures for water preheating, which permits reducing the number of regenerators and reduces the differential on circulation pumps, are recommended. (R.V.J.)

14269

HOW TRANSISTOR CIRCUITS PROTECT ATOMIC REACTORS. E. J. Wade and D. S. Davidson (General Electric Co., Schenectady, N. Y.). Electronics 31, No. 29, 73-5(1958) July 18.

An all transistorized trip system for experimental reactors to provide maximum safety against radiation hazards is described. A block diagram shows the arrangement used in the over-all system. Schematics are given of parts of the accidental trip and protective circuits. (J.S.R.)

14270

ANALYSIS OF TEMPERATURES AND EXPANSIONS RESULTING FROM EXPONENTIAL POWER CHANGES IN A REACTOR. Thomas R. Bump and Ralph W. Seidensticker (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 4, 44-64(1958) July.

Simple, analytic expressions for temperatures and axial fuel expansions in an exponentially heated, heterogeneous reactor are derived. Constant thermal resistances, equal to the steady-state values, are assumed, and the effects of using this assumption are discussed. Multiregion fuel elements are treated, both with and without coolant flow. The effect of mechanical inertia upon axial expansion of fuel rods with one fixed end is taken into account. Numerical examples which pertain to EBR-II are presented. (auth)

14271

CONTROL ROD WORTH STUDIES ON SEED AND BLANKET REACTORS. W. H. Hartley and R. T. Bayard (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 4, 65-72(1958) July.

A technique is described for determining control rod shutdown reactivity for tall reactors (small relative axial leakage) which may also be applicable to other reactor geometries. This method assumes that the rod bank region is an exponential assembly with the critical portion of the reactor as the driving source for the exponential. Comparison is made with the results obtained from the rod drop technique. (auth)

14272

A SYSTEM OF OBTAINING AND REDUCING NEUTRON FLUX DATA FROM A CRITICAL ASSEMBLY. H. A. Morewitz and R. F. Valentine (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 4, 73-81 (1958) July.

Some new techniques have been applied in the determination of relative neutron fluxes in water moderated critical assemblies. Alloy wires of Mn–Fe, In–Al, Au–Al, and U–Zr have been prepared with a high degree of uniformity between individual samples of a given material. Beta activation of these wires is measured by thin scintillation crystals in conjunction with specially stabilized electronics. This procedure results in good "plateaus" of counting rate vs. photomultiplier voltage, discriminator setting, and amplifier gain. The counting time of a wire is controlled by a decaying sample of the activated material. Thus, as the counting continues, the counting interval becomes progressively longer, providing automatic decay correction of the data. Several benefits are obtained from this method. The statistics of counting for a wire of a given activation level are independent of the time of counting; nonuniform decay (e.g., mixed fission product decay) is handled with the same facility as simple exponential decay. Automatic sample changers are used which make possible the counting of larger numbers of samples (approximately 1500 per day) with a minimum of personnel. These changers have been so adjusted that good precision in positioning is maintained. The automatic features of the counting system permit a rapid qualitative evaluation of the data. An error analysis has been made which indicates an experimental counting error (exclusive of statistical error due to decay) of approximately 0.8%. This error, when combined with the appropriate statistical error, has been applied to improve the use of computer codes in obtaining accurate least square fits of theoretical curves to the experimental data. (auth)

14273

HYDRODYNAMICS OF A LIQUID POISON SCRAM SYSTEM. David Burgreen (Nuclear Development Corp. of America, White Plains, N. Y.). Nuclear Sci. and Eng. 4, 82-95(1958) July.

A study is made of the transient motion of a suddenly released column of liquid poison, such as mercury or borated water, as it moves through the control tubes of a reactor. Two basic systems are described. The first system consists of a tank of liquid poison, situated above the reactor, connecting directly to control tubes extending down into the core. The second system is a U-tube arrangement in which the liquid poison enters through tubes that extend upward from the base of the core. By making the tank or standpipe diameter larger than the control tube diameter it is possible to obtain initial fluid column accelerations greater than gravitational acceleration. When solid control rods are used

in reactors, it is necessary to employ auxiliary springs to give an initial acceleration greater than gravitational. High initial accelerators are inherent features of liquid poison scram systems. It is found that the initial acceleration is gravitational acceleration multiplied by the ratio of standpipe area to control tube area. An exploitable feature of the U-tube system is that the liquid column undergoes a natural rapid deceleration. It may therefore be possible to do away with damping devices that are often required at the base of a solid control rod channel. The equations of motions of the system are derived and integrated. The general solution in both cases gives the displacement time explicitly in terms of elliptic functions; in the U-tube system the unconfined fluid column is found to execute uniform elliptic oscillations. (auth)

14274

REACTOR TRANSFER FUNCTIONS: ADDENDUM. M. N. Moore (Univ. of London). Nuclear Sci. and Eng. 4, 134-5(1958) July.

In a recent issue of this journal (Nuclear Sci. and Eng. 3, 387(1958)) an application of the theory of stochastic processes to reactor kinetics was presented. This note is a comment on the nature of stochastic force. (A.C.)

14275

ORGANIC SUBSTANCES AS REACTOR MODERATORS AND COOLING AGENTS. Jozef Pawlikiewicz (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Nukleonika 3, 287-98(1958). (In Polish)

The properties of organic substances used as reactor moderators and cooling agents are discussed. Diphenyl is discussed in detail. The advantages and disadvantages of a series of organic compounds are analyzed, and their suitability as moderators and cooling agents are assessed. (tr-auth)

14276

LINES OF REACTOR DEVELOPMENT. II. M. Bogaardt. R C N Bull. 2, 65-6(1958) June. (In Dutch)

In the second article on reactor development, the development of power reactors in Great Britain is discussed. (J.S.R.)

14277

REACTOR CORE MATERIALS. Technical Progress Reviews, Vol. 1, No. 3. Columbus, Battelle Memorial Institute, 1958. 60p. Available from U. S. Government Printing Office, Washington for $0.55.

A quarterly review of significant developments in the field of solid reactor core materials with emphasis on physical and mechanical properties, fabrication, radiation damage, metallurgy, and corrosion is presented. It is intended to provide readers with a convenient condensed source of information to keep abreast of developments in a general way. (W.D.M.)

Nuclear Transformation

14278 NP-5849(Rev.)

Naval Research Lab., Washington, D. C.

BIBLIOGRAPHY OF PHOTONUCLEAR REACTIONS. Bibliography No. 14. (Revision of Bibliography No. 2). M. Elaine Toms, comp. Aug. 1958. 102p.

A comprehensive listing of theoretical and experimental results of photonuclear reactions is presented. The scope of this bibliography covers reactions in which nucleons or aggregates of nucleons are emitted. This compilation consists of 859 references by 758 contributing authors. An author index is included. (J.E.D.)

14279

PHOTONEUTRONS FROM NATURAL MAGNESIUM. B. M. Spicer, F. R. Allum, J. E. E. Baglin, and H. H. Thies (Univ. of Melbourne). Australian J. Phys. 2, 273-6(1958) June.

Natural magnesium was irradiated with bremsstrahlung in an electron synchrotron to determine the neutron yield as a function of synchrotron energy between 8 and 17 Mev. The neutron yield was measured and corrected for background, and the data are graphed as cross section vs. energy. (J.R.D.)

14280

SHAPE EFFECTS IN DEUTERON STRIPPING ON SPHEROIDAL NUCLEI. J. Sawicki (Princeton Univ., N. J.) and G. R. Satchler (Clarendon Lab., Oxford). Nuclear Phys. 7, 289-95(1958) June (3).

The geometrical effect of the spheroidal shape of strongly deformed nuclei on the angular distributions from deuteron stripping reactions is discussed. The usual boundary conditions are assumed, not on a Butler sphere of radius r_0, but rather on a corresponding spheroidal boundary. This gives rise to contributions to the reaction amplitude, additional to the "spherical" parts, which correspond to angular momenta L different in general from the orbital angular momentum l of the captured nucleon. They do not, however, violate the strong coupling model selection rule $L \geq |K_f - K_i| - \frac{1}{2}$; in particular $L = 0$ can only occur if $|K_f - K_i| = \frac{1}{2}$. These shape contributions are in general rather small, but must be considered when attempts are made to correlate experimental widths with the nuclear collective model and to detect small configuration mixing effects. (auth)

14281

PHOTONEUTRON THRESHOLDS FOR IRON, GERMANIUM, RUBIDIUM, AND HAFNIUM. R. Tobin, J. McElhinney, and L. Cohen (U. S. Naval Research Lab., Washington). Phys. Rev. 110, 1388-91(1958) June 15.

Photoneutron thresholds for Fe^{56}, Fe^{57}, Ge^{73}, Rb^{85}, Rb^{87}, Hf^{177}, and Hf^{179} have been measured by using bremsstrahlung from a 22-Mev betatron as a photon source. The photon-induced reactions were observed by neutron detection supplemented in one case by radioactivity determinations. A comparison of these thresholds with neutron binding energies revealed that, for some of the nuclei, better agreement was obtained if formation of the residual nucleus in an excited state instead of in the ground state was assumed. The neutron binding energies inferred from these measurements are: 11.34 ± 0.10 Mev for Fe^{56}; 7.85 ± 0.13 Mev for Fe^{57}; 6.50 ± 0.16 Mev for Ge^{73}; 10.50 ± 0.08 Mev for Rb^{85}; 9.89 ± 0.05 Mev for Rb^{87}; 6.70 ± 0.09 Mev for Hf^{177}; and 6.52 ± 0.12 for Hf^{179}. (auth)

14282

RADIATIVE CAPTURE OF ALPHA PARTICLES TO STATES OF O^{18} AND F^{18}. W. R. Phillips (Univ. of Wisconsin, Madison). Phys. Rev. 110, 1408-13(1958) June 15.

The radiative capture of alpha particles in N^{14} and C^{14} has been studied for bombarding energies between 1.3 and 3.0 Mev. Four narrow resonances were observed in the reaction $N^{14}(\alpha,\gamma)F^{18}$, corresponding to levels in F^{18} at 5.60, 5.67, 6.24, and 6.65 Mev. Two narrow resonances were observed in the reaction $C^{14}(\alpha,\gamma)O^{18}$, corresponding to levels in O^{18} at 7.63 and 8.05 Mev. These

two are 1^- states. The decay schemes of some of these levels were partly elucidated, and several partial radiative widths were measured. The decays studied gave information on the low-lying levels in F^{18} and O^{18}. (auth)

14283

PHOTOPROTONS FROM N^{15}. Jacob L. Rhodes and W. E. Stephens (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 110, 1415-19(1958) June 15.

The photoprotons ejected by bremsstrahlung photons from nitrogen gas enriched in N^{15} were detected in nuclear emulsions and the proton energy and angular distributions measured for 18.7- and 24.6-Mev betatron energies. The photoproton yield is 10^5 protons per atomic weight per roentgen unit at 24.6 Mev. The integrated cross section in the giant resonance is 10-Mev millibarns for ground-state transitions. Structure is observed in the giant resonance and the angular distributions in this region are predominantly $\sin^2\theta$. (auth)

14284

RESONANT ABSORPTION OF GAMMA RADIATION FROM THE $Si^{30}(p,\gamma)P^{31}$ REACTION. P. B. Smith and P. M. Endt (Rijksuniversiteit te Utrecht, Netherlands). Phys. Rev. 110, 1442-5(1958) June 15.

The technique of collision-produced Doppler shift has been used to induce resonant absorption. The gamma rays emitted by excited P^{31} from the $Si^{30}(p,\gamma)P^{31}$ reaction at $E_p = 622$ kev have been selectively absorbed in phosphorus. Resonant absorption of the 7.90-Mev gamma rays emitted from this level occurs at 76.6 degrees with respect to the proton beam direction. Since the experimental absorption curve is broader than the previously measured instrumental resolution curve, it has been possible to determine directly the total width of the resonance level as 40 ± 7 ev. From the absorption integral, together with this value of the total width, the radiation width for transitions to the ground state is found to be 1.52 ± 0.12 ev. A $\frac{1}{2}^+$ spin assignment is made on the basis of the partial widths thus obtained. (auth)

14285

MEASUREMENT OF SPINS OF LEVELS EXCITED BY SLOW NEUTRON CAPTURE. J. D. Fox, R. L. Zimmerman, D. J. Hughes, H. Palevsky, M. K. Brussel, and R. E. Chrien (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 110, 1472-4(1958) June 15.

The spectrum of the gamma rays following neutron capture in individual resonances can be used to determine the spin of the levels corresponding to the resonances in certain cases. Results are reported in which the method has been successfully applied to the determination of the spins of several levels in W^{184}. (A.C.)

14286

R-MATRIX THEORY OF NUCLEAR REACTIONS. A. M. Lane (Atomic Energy Research Establishment, Harwell, Berks, Eng.) and R. G. Thomas (Los Alamos Scientific Lab., N. Mex.). Revs. Modern Phys. 30, 257-353(1958) Apr.

Advances made in the theoretical study of nuclear reactions during the last twenty years are described. (W.D.M.)

14287

SEMIEMPIRICAL CORRELATION OF FISSION YIELD AND KINETIC ENERGY DISTRIBUTIONS. A. G. W. Cameron (Atomic Energy of Canada Ltd., Chalk River, Ont., Can.). Revs. Modern Phys. 30, 553-7(1958) Apr.

The energy released in all the significant fission modes in thermal neutron fission was calculated from a revised semiempirical atomic mass formula, and pairing energies were subtracted to give the effective energy releases. It was found that predictions of fission yields bore little resemblance to the yields determined experimentally. The yields were sharply peaked at a mass ratio of 1.34, and there was only a very shallow valley. (W.D.M.)

14288

EMISSION OF PARTICLES FROM EXCITED NUCLEI. M. Z. Maksimov. Soviet Phys. JETP 6, 1085-90(1958) June.

A formula for the dependence of the cross section of a nuclear reaction, involving the emission of several particles, on the energy of incident nuclei has been obtained using the statistical theory of the nucleus and Bohr's concept of nuclear reactions. The formula has been used to compute the cross sections for nuclear reactions involving the emission of 1, 2, 3, or 4 neutrons from Bi^{209} and I^{127} when bombarded with protons, deuterons, or α particles. The dependence of the entropy of a nucleus on the excitation energy and mass number has been determined using the gas model of the nucleus. The results of the calculations agree satisfactorily with the experimental data. (auth)

14289

THE ELECTRODISINTEGRATION OF NUCLEI AT HIGH ENERGIES. M. Ya. Kobiashvili (Tbilisi State Univ.). Soviet Phys. JETP 6, 1162-3(1958) June.

The cross section for the electrodisintegration of nuclei are calculated under conditions when it would be meaningless to expand the external field, which is given in Møller potentials, in terms of multipoles. This case can occur when $|q| = |q_i - q_f| > \hbar c/R$, where q_i/c and q_f/c are the momentum of the electron before and after scattering and R is the nuclear radius. (J.S.R.)

Particle Accelerators

Refer also to abstracts 14457 and 14468.

14290 AERE-G/M/151

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

DESIGN STUDY FOR A 600 MEV PROTON LINEAR ACCELERATOR. Résumé of Progress up to January 1953, and the Future Programme. L. B. Mullett. Apr. 1953. 25p.

An account of the design study for a 600-Mev proton linear accelerator is presented. It indicates a conclusion of much of the preliminary work and sets forth a specific program of work toward a tangible design for the accelerator. (J.R.D.)

14291 AERE-T/R-2495

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

AN F.F.A.G. SYNCHROTRON WITH STRAIGHT SECTIONS HAVING ACCEPTABLE BETATRON OSCILLATIONS. R. Taylor and M. J. Mitchell. Mar. 1958. 36p. $0.99(BIS).

A method of inserting radially-cut straight sections in an F.F.A.G. machine is presented, which reduces the effects of the resultant lack of scaling on the particle dynamics. General considerations concerning the superperiod structures of such machines are discussed, and possible design parameters are given, on the basis of computed orbits, for a 15-Bev machine. (auth)

14292 CERN-58-11
European Council for Nuclear Research, Geneva.
THE HANDLING EQUIPMENT FOR THE RADIATION SHIELDING BLOCKS OF THE CERN PROTON SYNCHROTRON. A. H. Achermann. June 1958. 16p.

The continuity of radiation protection of personnel working in the proton synchrotron workshop and adjacent offices requires a continuous baryte concrete shielding wall, about 5 m thick, inside the experimental hall on either side of the tunnel. The equipment for rearranging and handling the concrete blocks is described. (W.D.M.)

14293 CERN-58-16
European Council for Nuclear Research, Geneva.
4. DESIGN OF R. F. MODULATION SCHEMES. SOME PROBLEMS IN THE DESIGN OF A 100 MeV INTERSECTING-BEAM ELECTRON ACCELERATOR. M. J. Pentz. July 1958. 30p.

The construction of a high-current intersecting beam electron accelerator of about 100-Mev energy is discussed. The essential characteristics of the r-f modulation scheme required for such an accelerator depend upon a number of rather general considerations of the functions and characteristics of the accelerator as a whole. The r-f requirements for application to an accelerator of this type are discussed. (W.D.M.)

14294 ISC-1008
Ames Lab., Ames, Iowa.
FARADAY CUP MONITOR FOR THE IOWA STATE COLLEGE SYNCHROTRON ELECTRON BEAM. Roderick D. Riggs and C. L. Hammer. Dec. 1957. 38p. Contract W-7405-eng-82. $1.25(OTS).

The design, construction, and testing of two high-energy electron beam monitors are described. One, a Faraday cup, is an absolute measuring device, and the other is a secondary emission monitor. The procedure and results necessary to calibrate the secondary emission monitor against the Faraday cup are included. Since the secondary emission monitor is portable, it is an adaptable instrument for the absolute measurement of high energy electron beams after it has been so calibrated. (auth)

14295 NP-6903
Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.
METHOD OF CHARGED PARTICLE FOCUSING IN ACCELERATORS. V. I. Danilov and O. V. Savchenko. 1958. 18p.

A variant of charged particle focusing obtained with a synchrocyclotron is considered. The particle focusing is achieved by the magnetic field formed in the gap of the deviating electromagnet with the help of iron bars. It is shown that the effect of the focusing arrangement is equivalent to that of the magnetic quadrupole lens if the definite ratio of the dimensions of these bars is maintained. By means of such lenses the density of the 600-Mev polarized proton beam intensity was increased three times in the place where the detecting arrangement was set up; the density of the ~300-Mev meson beam intensity was increased 2.7 times. (auth)

14296 UCRL-8021
California. Univ., Berkeley. Radiation Lab.
BEVATRON OPERATION AND DEVELOPMENT. XIII. [Period covered] February, March, April 1957. Walter Hartsough and William Salsig. Apr. 1, 1958. 43p. Contract W-7405-eng-48. $1.25(OTS).

During this entire quarter, the Bevatron was shut down for major rework of the magnet-coil air shroud and for the scheduled construction of a new experimental area at the north straight section. The existing west and northwest experimental areas were also improved. The Bevatron motor-generator sets and associated ignitrons were overhauled. At the end of this period, the magnet coil rework is concluded and the scheduled shutdown work is well advanced. (auth)

14297 UCRL-8033
California. Univ., Berkeley. Radiation Lab.
MEASUREMENT OF BEAM CURRENT IN THE BEVATRON BY INDUCED VOLTAGES (thesis). John T. Lavrischeff. Oct. 28, 1957. 40p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

The Bevatron uses a system of electrodes through which the internal proton beam passes in order to continuously measure the magnitude and radial position of the beam. The bunched circulating beam induces a periodic voltage on the electrodes. This signal is amplified and displayed on an oscilloscope and also converted to direct current for operation of a recorder. Two types of electrode systems are used. The first is a large hollow box to provide beam magnitude signals for specialized monitoring and for primary calibration. The second system consists of two sets of smaller electrodes. One set provides beam radial-position information for tracking control, and the other provides beam magnitude information for magnitude control and for general distribution to experimenters associated with the Bevatron. A telemetering radio link is used to relay beam information to those in other areas. Problems associated with handling the beam signal are discussed, and the design principles involved in detection, amplification, and isolation of the signal are described. Calibration techniques, signal distribution facilities, and control features are also given. The systems described are stable and provide the desired information with a minimum of maintenance and operational difficulty. (auth)

14298 UCRL-8282
California. Univ., Berkeley. Radiation Lab.
ROTANGER: A PROGRAM FOR CALCULATING ORBITS IN A CYCLOTRON BY THE USE OF THE IBM-650 DATA-PROCESSING COMPUTER. Warren Fenton Stubbins. May 12, 1958. 28p. Contract W-7405-eng-48. $1.00(OTS).

Three simultaneous polar-coordinate component equations in an aximuthally homogeneous magnetic field of a cyclotron are integrated by a fixed-point program on the IBM 650 computer to give the orbits of particles in the cyclotron. A regenerator action for extracting particles is computed as an inpulse once each turn as a subprogram when desired. The program is described and instructions for its use are included. (auth)

14299 NP-tr-109
DAMPING THE OSCILLATION OF PARTICLES IN AN ELECTRON SYNCHROTRON WITH STRONG FOCUSING. Yu. F. Orlov, E. K. Tarasov, and S. A. Kheifetz. Translated for U.K.A.E.A., Atomic Energy Research Establishment. 7p.

Methods for damping the oscillations of particles by varying the magnetic field along the orbit of an electron synchrotron are discussed. (A.C.)

14300 NP-tr-115
ON RAISING THE LIMITING ENERGY AND IMPROVING THE FOCUSING OF A CYCLOTRON. E. M. Moroz and M. S. Rabinovich. Translated for U.K.A.E.A. Atomic Energy Research Establishment from Pribory i Tekh. Eksper. 1, 15(1957). 13p.

A sectionalized magnetic system for fixed-frequency cyclotrons is discussed. The relationship between the frequency of revolution and the energy, as well as the required focusing of the particles, can be obtained by selecting the appropriate form for the sectors of the field. A rational choice of the coefficient makes it possible to avoid passing through the most harmful resonances of betatron oscillations. A method is presented for preserving cyclotron resonance. Discussions are included on the cyclotron region of vertical stability, harmful resonances, and measures to get rid of them. A method of improving focusing and tolerances of particle movement are discussed. (J.R.D.)

14301 NP-tr-116

THE OCCURRENCE OF INSTABILITY WHEN A LARGE GRADIENT EXISTS IN AN ELECTRON ACCELERATOR WITH STRONG FOCUSSING. Yu. F. Orlov and E. K. Tarasov. Translated by V. Beak (U.K.A.E.A. Atomic Energy Research Establishment). 7p.

With a high gradient (η of the order of several hundreds) in an electron accelerator, instability of the betatron or phase oscillations may occur. The effect appears as a result of the combined action of radiation and resonance irregularities of the magnetic field. (auth)

14302

OPERATION OF A RADIAL SECTOR FIXED-FREQUENCY PROTON CYCLOTRON. F. A. Heyn and Khoe Kong Tat (Technical Univ., Delft, The Netherlands). Rev. Sci. Instr. 29, 662(1958) July.

The operation of a variable energy cyclotron, using only one dee, is described. (A.C.)

Radiation Absorption and Scattering

14303 NP-6851

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

APPLICATION OF DISPERSION RELATIONS TO $\pi-N$ SCATTERING AT LOW ENERGIES. L. I. Lapidus. 1958. 20p.

The consequences of dispersion relations for scattering at low energies are investigated without passing to the Low type equation. The relations between the scattering lengths in different states have been obtained from the values of the derivatives of the dispersion relations when $k^2 = 0$. (auth)

14304 NP-6852

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

APPROXIMATE EQUATIONS FOR PHOTON SCATTERING AMPLITUDE ON NUCLEONS. A. N. Tavkhelidze and V. K. Fedjanin. 1958. 19p.

The approximate equations for the photon scattering amplitudes on nucleons were obtained by using the dispersion relations for Compton scattering. (W.D.M.)

14305 NP-6859

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

DISPERSION RELATIONS FOR PION-DEUTERON SCATTERING. II. F. Kaschluhn. 1958. 12p.

The dispersion relation for the elastic spin-flip forward scattering of pions by deuterons is derived and compared with the experimental data by means of Chew's impulse approximation. Unlike the former treated case of the elastic forward scattering without spin-flip the contribution from the non-observable region in the dispersion relation is now large and allows a determination of the pion-nucleon coupling constant. Its value is in accordance with that following from dispersion relations for pion scattering on free nucleons. The investigations show the practical possibility for treating bound states in the framework of the theory of dispersion relations, for which, however, it is necessary to perform explicitly the analytic continuation because of the divergences appearing in the matrix elements of the non-observable region. (auth)

14306 NP-6872

Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.

ON ELASTIC NUCLEON SCATTERING BY NUCLEI. G. A. Leksin. 1957. 12p.

The impulse approximation was successful in calculating high-energy nucleon-deuteron elastic scattering. This made it possible to make an attempt to apply it for calculations of the angular dependence of the differential cross sections of elastic nucleon-nucleus scattering. Such calculations are of interest from the methodical standpoint and make it possible to draw some physical conclusions which are apparently not dependent on the use of a number of simplifying assumptions. The comparison of the results of the calculations with experiment on proton elastic scattering at 340 Mev on carbon has been made to illustrate the possibility of applying the formulas obtained. (A.C.)

14307 NP-6873

Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.

SMALL-ANGLE NEUTRON-PROTON ELASTIC SCATTERING AT 580 MEV. N. S. Amaglobeli and Y[u]. M. Kazarinov. 1957. 14p.

The differential 580-Mev neutron-proton elastic scattering cross sections for the angles 11°, 23°, and 35° (center of mass system) have been measured. A sharp rise of the cross sections with the decrease of scattering angle has been found. The results point out the approximately equal probability of the "forward" and "backward" scattering. (auth)

14308 NP-6909

Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.

IMPULSE APPROXIMATION AND DISPERSION RELATIONS FOR PION-DEUTERON SCATTERING. Frank Kaschluhn. 1958. 13p.

The recently derived dispersion relation for elastic forward scattering of pions by unpolarized deuterons is compared with the experimental data in the sense that the results of Chew's impulse approximation are adopted. It is shown that the dispersion relation is consistent with these data. But for a more detailed test of the theory it is necessary to consider other π-d processes for which the contribution from the non-observable part in the dispersion relations is no small quantity. It is indicated that for this the consideration of the elastic forward scattering amplitude for spin-flip is sufficient. (auth)

14309

THE MILNE PROBLEM IN ANISOTROPIC SCATTERING (APPLICATION TO THERMAL NEUTRONS). D. Lyons. Ann. Physik 1, 400-23(1958). (In German)

The celebrated Milne problem was investigated and it was shown that the "standard problem" could be solved without special analytical auxiliaries (as function theory) in very good approximation, but only when elementary scattering processes were assumed from the

beginning. The density distribution at the edge of the medium was developed according to exponential integrals. The "isotope" drop could be determined by extrapolation. A proof of the well-known Hopf-Bronstein equation was also given. It was established why the treatment in isotropic scattering is so very complicated. The deviations from isotropism, as far as they are not already included in the transport path, ought to be detectable experimentally. (tr-auth)

14310

CHARGE DEPENDENT EFFECTS ON SCATTERING LENGTHS OF np AND pp SYSTEMS. Riazuddin (Imperial Coll. of Science and Tech., London). Nuclear Phys. 7, 217-22(1958) June (3).

The effects of the electromagnetic structure of a nucleon on the singlet scattering lengths a_{np}, a_{pp} of np and pp systems are calculated. They are found to be much too small to remove the discrepancy between a_{np} and a_{pp}. It is shown to be plausible that the discrepancy between a_{np} and a_{pp} may be due to $\pi^{\pm}-\pi^{0}$ mass difference when its kinematic and dynamical effects, as defined in the text, are taken into account. (auth)

14311

POLARIZATION IN THE ELASTIC SCATTERING OF 2-3 Mev NEUTRONS BY DEUTERONS. R E. White, A. Chisholm, and D. Brown (Univ. of Auckland, New Zealand). Nuclear Phys. 7, 233-6(1958) June (3).

Large polarization effects have been observed in the elastic scattering of polarized neutrons from the D-D reaction by deuterons. The polarization for 90° center of mass scattering is 0.58 ± 0.05 at 2.26 Mev and 0.86 ± 0.19 at 3.1 Mev and was measured by studying the asymmetry in the distribution of recoil deuterons in deuterium filled proportional counters. (auth)

14312

INELASTIC SCATTERING OF PROTONS AT INTERMEDIATE ENERGIES. N. Oda (Rikkyo (St. Paul's) Univ., Tokyo) and K. Harada (Japan Atomic Energy Research Inst., Tokai-mura, Ibaragi-ken). Nuclear Phys. 7, 251-62(1958) June (3).

The differential cross sections for the inelastic scattering of protons at intermediate energies are calculated in an analytical way on the basis of the statistical independent particle model with a diffuse nuclear surface, assuming that main contribution to the cross section comes from the direct interactions of incident protons with the target nucleons penetrating out beyond some critical radius in the diffuse rim of the nucleus, and taking the Pauli principle exactly into consideration. The contribution of the compound nucleus formation process to the cross section was also estimated. The application to the inelastic scattering of 31 Mev protons by Sn leads to values of the cross sections in good agreement with the experiment. (auth)

14313

THE SCATTERING OF 185 Mev PROTONS FROM DEUTERIUM AND NEON. H. Tyrén, G. Tibell, and Th. A. J. Maris (Univ. of Uppsala). Nuclear Phys. 7, 281-3(1958) June (3).

The energy spectra of 185-Mev protons scattered off deuterium and neon have been recorded with a magnetic analyzer. Gaseous targets were used, and five angles in the region 10° to 28° were studied. (auth)

14314

AZIMUTHAL SYMMETRY IN PROTON SCATTERING AT 980 Mev. N. E. Booth, F. L Hereford, M. Huq, G. W. Hutchinson, Margaret E. Law, A. M. Segar, and D H. White (Univ. of Birmingham, Eng.). Nuclear Phys. 7, 284-8(1958) June (3).

The relative intensities of protons scattered near the vertical and near the horizontal planes at the second event of a double scattering process have been studied, the first scattering having taken place in the horizontal plane. Protons of kinetic energy 980 Mev were scattered first from carbon at 4° and then from either carbon or polyethylene at 14°. They were detected by an array of scintillation counters which could be rotated about an axis along the flight path of the protons between the two scatterers, and which was arranged so as to detect preferentially the elastic proton-proton scattering in the polyethylene. The ratio of horizontal to vertical scattering was found to be 0.940 ± 0.056, in proton-proton collisions. (auth)

14315

INELASTIC SCATTERING OF 96 Mev PROTONS. Keiichi Nishimura (Rutgers Univ., New Brunswick, N. J.). Nuclear Phys. 7, 425-8(1958) July (2).

An analysis is made of the angular distribution of 96-Mev protons inelastically scattered by carbon. It was found that by using the collective model of the nucleus the agreement to the experimental results is as good as the previous calculations based upon the individual particle model of the nucleus. (auth)

14316

INELASTIC SCATTERING OF NUCLEONS AND DEUTERONS FROM SPHEROIDAL NUCLEI. J. Sawicki (Princeton Univ., N. J.). Nuclear Phys. 7, 503-15(1958) July (2).

A direct interaction theory of the inelastic scattering of nucleons and deuterons from strongly deformed nuclei of $A \approx 25$ is proposed. The nucleus is described by the strong coupling approximation of the unified nuclear model. Two alternative forms of the transition operators are discussed: the projectile-surface interaction and the interparticle forces (projectile-target nucleons). Both the rotational and the individual particle excitations are discussed. As an example of the recent data on the $Mg^{24}(d,d')$ and $Mg^{24}(p,p')$ reactions are considered. Angular correlations with γ's are discussed. The case of the 2+ (rotational level) → 0 + E2-radiation is considered in detail. (auth)

14317

NEUTRON SCATTERING BY ANTIFERROMAGNETS ABOVE THE NÉEL POINT. P. G. De Gennes (Centre d'etudes nucléaires de Saclay, Gif-sur-Yvette, France). Phys. and Chem. Solids 6, 43-5(1958) July.

The general features of scattering in the elastic approximation are displayed by using the concept of a wavelength-dependent susceptibility. "Critical" scattering occurs above the Néel point, in the directions which would correspond, below the Néel point, to superlattice lines. The shape of the diffuse spots is given in terms of the Néel and paramagnetic Curie temperatures, for various types of lattices. (auth)

14318

NEUTRON NONELASTIC CROSS SECTIONS FROM 7 TO 14 Mev. William P. Ball, Malcolm MacGregor, and Rex Booth (Univ. of California, Livermore). Phys. Rev. 110, 1392-4(1958) June 15.

Neutron nonelastic cross sections for seven elements have been measured over the range from 7 to 14 Mev. The cross sections are almost constant in this range, showing that variations in the total cross sections are due primarily to variations in the elastic cross sections. (auth)

14319

POLARIZATION MEASUREMENTS IN p-α ELASTIC SCATTERING. Mary Jean Scott (Johns Hopkins Univ.,

Baltimore and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 110, 1398-1405(1958) June 15.

The polarization of protons elastically scattered from alpha particles was observed by measuring the asymmetry obtained by doubly scattering protons in helium. Protons from the Brookhaven National Laboratory Van de Graaff generator entered a helium-filled double-scattering chamber through a 50-micro-inch nickel window. The first scattering was at either 104° 29′ (c.m.) or 73° 38′ (c.m.) and the second scattering was to left and right at 73° 38′ (c.m.). The doubly scattered protons were detected by 50-μ Ilford C-2 plates. The polarization product, P_aP_b, was calculated from the left-right ratio (R) using the formula $R = (1 + P_aP_b)/(1 - P_aP_b)$, where P_a and P_b are the polarizations at the first and second scatterings, respectively. Three interdependent measurements, in which P_aP_b was equal to P_1P_2, P_1P_3, or P_2P_3, yielded values for P_1[3.580 Mev, 104° 29′ (c.m.)], P_2[2.020 Mev, 73° 38′ (c.m.)], and P_3[1.375 Mev, 73° 38′ (c.m.)]. The calculated polarizations are in the direction of the normal n ($n = k_0 \times k/|k_0 \times k|$) to the scattering plane. The results are given. (auth)

14320

ELASTIC SCATTERING OF 14-Mev NEUTRONS FROM BERYLLIUM AND CARBON. M. P. Nakada, J. D. Anderson, C. C. Gardner, and C. Wong (Univ. of California, Livermore). Phys. Rev. 110, 1439-41(1958) June 15.

The angular distributions of elastically scattered 14-Mev (nominal energy) neutrons have been measured for beryllium and carbon from 20° to 140°. Ring geometry, time-of-flight techniques, and relatively low detector biases were used. A comparison with optical-model calculations by Bjorklund and Fernbach indicates that the parameters that fit the medium and heavy elements do not yield satisfactory fits for beryllium and carbon. (auth)

14321

ANTIPROTON-HYDROGEN SCATTERING AND INELASTIC SCATTERING FROM COMPLEX NUCLEI. Gerson Goldhaber, Theodor Kalogeropoulos, and Rein Silberberg (Univ. of California, Berkeley). Phys. Rev. 110, 1474-6 (1958) June 15.

The rare types of antiproton interactions that do not lead to annihilation are discussed, namely, the p-H scattering events and the antiproton inelastic scattering events. The elastic scattering of antiprotons from free hydrogen nuclei can be identified uniquely in photographic emulsions from the kinematics of the events. (A.C.)

14322

ELASTIC SCATTERING OF ANTIPROTONS FROM COMPLEX NUCLEI. Gerson Goldhaber and Jack Sandweiss (Univ. of California, Berkeley). Phys. Rev. 110, 1476-8(1958) June 15.

Measurements are reported on the elastic scattering of antiprotons in nuclear emulsion. The total path length was obtained from the various exposures to the unseparated antiproton beam and from a separated beam exposure. In these experiments, stocks of 600-μ Ilford G-5 nuclear emulsion have been exposed to antiprotons from the Berkeley Bevatron. For the purpose of the elastic scattering measurement only tracks due to antiprotons identified by means of an annihilation star have been selected. The results of the experiments are tabulated. (A.C.)

14323

NUCLEAR SCATTERING. Cambridge Monographs on Physics. K. B. Mather and P. Swan. New York, Cambridge University Press, 1958. 477p. $14.50.

As an introduction to a monograph on the physics of nuclear scattering, the relationship of nuclear scattering to nuclear forces is discussed in some detail. A section on theoretical concepts and experimental methods leads to a description of charged particle scattering techniques and neutron scattering techniques. As in all scattering experiments it is necessary to determine the energy of the incident particles at the target, a special section is devoted to the determination of beam energy. The remaining sections of this book deal with the theory of nuclear scattering and comparison with experimental data. The topics discussed include low-energy proton-proton scattering, scattering of neutrons and protons by very light nuclei, non-central forces and spin-orbit coupling, high-energy neutron-proton and proton-proton scattering, high-energy scattering of neutrons, protons, and deuterons by light nuclei, and nuclear models and resonance scattering. The treatment is not introductory, and a general acquaintance with quantum mechanics and with the elementary scattering formulas is assumed. (J.S.R.)

Radiation Effects

14324 AERE-HP/M-100

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

CALCULATION OF FISSION PRODUCT ACTIVITIES IN IRRADIATED THORIUM AND URANIUM. D. V. Booker. Oct. 31, 1955. 19p.

A method is given for calculating gross fission product activity in thorium irradiated to produce U^{235}. Also, presented are methods of calculating the activity of single and gross fission product activity in irradiated natural uranium. Specimen calculations are included. The aim is to present the available data in a convenient form for the assessment of health physics problems arising in the handling of irradiated samples. (auth)

12325 AERE-M/R-2536

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECTS OF NEUTRON IRRADIATION ON THE DUCTILE-BRITTLE TRANSITION TEMPERATURES OF WELDABLE STRUCTURAL STEEL PLATES. EXAMINATION OF A WELDED DUCOL W.30 STEEL PLATE OF 4 5/8 in. THICKNESS. R. C. Burnett, J. M. N. Allen and D. R. Harries. Apr. 1958. 31p.

Neutron irradiation effects on the notched-bar properties of a 4⅝ in. thick welded Ducol W. 30 steel plate are described. Notched specimens machined from various levels in the parent plate and weld metal were irradiated to integrated neutron doses of 4×10^{19} and 7.6×10^{19} n/cm^2 at both 50 to 60°C and 130 to 140°C and tested in slow bend. Irradiation increases the ductile-brittle transition temperatures and lowers the maximum (ductile) energies, but the parent plate and weld metal are not equally affected. The magnitudes of the changes are also governed by the temperature of irradiation and the integrated neutron flux. (auth)

14326

THE IONIZATION OF LIQUID ARGON BY α-PARTICLES. F. D. Stacey (Australian National Univ., Canberra). Australian J. Phys. 2, 158-67(1958) June.

Calculations suggest that in liquid argon the column

of ionization produced by an α particle consists of a core of positive charge 0.6 to 1.5×10^{-5} cm in diameter concentric with a larger cloud of electrons extending to a diameter of 40×10^{-5} cm. This leads to a new description of charge separation in an applied electric field, in which the positive and negative charges are drawn apart slightly (polarized) and the more energetic electrons escape from the edge of the column. The remaining electron cloud reaches a state of dynamic equilibrium with the excess positive charge in a time short compared with that required for ionic recombination, which does not have a significant effect on the ionization current. The distribution of electron energies in the column of ionization is calculated from the results of recent ionization current measurements, and indicates that a 5.3 Mev α particle expends 0.5 Mev as kinetic energy of the liberated electrons. (auth)

14327

THE SECONDARY ELECTRONIC EMISSION OF METALS BOMBARDED BY POSITIVE IONS. Georges Slodzian. Compt. rend. 246, 3631-4(1958) June 30. (In French)

The secondary electron emission of various metals bombarded with positive ions was studied. The experimental arrangement is briefly described. The factors affecting secondary electron emission are discussed, and the ratio of secondary electron intensity to the incident ionic intensity is tabulated for air and argon. Secondary ion emission was also observed, and the ratio of secondary ionic intensity to incident ionic intensity is tabulated for air and argon. (J.S.R.)

14328

THE EFFECT OF NEUTRON IRRADIATION ON THE MECHANICAL PROPERTIES OF COPPER AND NICKEL. M. J. Makin (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inst. Metals 86, 449-55(1958) June.

The effect of neutron irradiation at 100°C with 5×10^{19} neutrons/cm^2 on the mechanical properties of annealed polycrystalline copper and nickel has been studied at a variety of temperatures. The yield stress of both metals is increased by the irradiation, and the increase is markedly temperature-dependent, being very much greater at low temperatures than at high. The temperature variation in yield stress after irradiation is a reversible phenomenon and is not due to an annealing effect at the higher temperatures. The rate of work-hardening is greatly reduced by the irradiation, especially at low strains. The ultimate tensile strength is increased and the elongation to fracture is reduced by irradiation. The results are discussed in terms of the possible mechanisms of irradiation-hardening. (auth)

14329

EFFECTS OF NUCLEAR RADIATION ON SEMICONDUCTORS. Henryk Rzewuski (Inst. of Nuclear Research, Academy of Sciences, Warsaw). Nukleonika 3, 255-72(1958). (In Polish)

A review is given of the processes occurring in semiconducting materials under the influence of nuclear radiation. Three different types of processes leading to nuclear transformation, lattice defects, and transitory phenomena are discussed. Data and tables published in the last few years are included. (tr-auth)

14330

FAST-NEUTRON-INDUCED CHANGES IN QUARTZ AND VITREOUS SILICA. William Primak (Argonne National Lab., Lemont, Ill.). Phys. Rev. 110, 1240-54(1958) June 15.

The course of the changes produced by exposure in nuclear reactors and the subsequent alteration of the radiation-induced property changes caused by heating were followed by measuring the dilatation, refractive index, rotatory power, and birefringence. The fast-neutron dosages determined by a comparison of radiation damage in several substances are used to give a consistent scale for presenting the effects seen from the initial changes to nearly the saturation state, despite the many irradiation facilities used for the work. The property changes resulting from heating specimens irradiated to various extents are given. The damaging phenomena are explained in terms of the interaction of the scattered atoms with the silica structure, and the annealing phenomena in terms of the behavior of the anticipated structural changes. On the basis of the effect of displaced atoms and thermal spikes on solid structures there are delineated a number of classes of radiation damage among insulators. For one of these, silica is taken to be the prototype. Thermal spikes cause the displaced atoms to be accommodated by a local deformation, which is depicted as analogous to the rapid inversions in which a minor reorientation of the Si-O tetrahedra occurs without extensive disruption of the structure. The resulting gradually accumulating disorder is considered the basic formulation of a metamictization for which the damaging of quartz thus becomes the simplest example. The same basic processes are considered to take place in vitreous silica; but since the substance is already disordered, the changes which take place are minor, the slight compacting of the structure evidently representing mainly the partial freezing-in of a high-temperature state produced by the thermal spike. (auth)

14331

ELECTRON-BOMBARDMENT DAMAGE IN SILICON. G. K. Wertheim (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 110, 1272-9(1958) June 15.

The nature of 1-Mev electron-bombardment damage in silicon is investigated by using Hall effect, conductivity, and carrier-lifetime measurements. It is shown that the bombardment imperfections consist of sites containing at least two electrically active point defects. The connection between these sites and the energy levels in the forbidden gap found in an earlier investigation is established. The state of charge, the electron and hole-capture cross sections, and the temperature dependence of the energy levels of these imperfections are obtained. (auth)

14332

THE INITIATION OF EXPLOSION BY NEUTRONS, α-PARTICLES AND FISSION PRODUCTS. F. P. Bowden. Proc. Roy. Soc. (London) A246, 216-19(1958) July 29.

Crystals of lead azide, silver azide, cadmium azide, silver acetylyde, and nitrogen iodide were coated with a thin film of uranium oxide and irradiated with slow neutrons. Only the nitrogen iodide exploded. This was further evidence that the excitation or decomposition of a few adjacent azide molecules does not lead to explosion. The irradiation of nitrogen iodide by α particles does not produce an explosion unless there is impact by a large number of the particles. It is suggested that the passage of a single particle (even a large fission fragment) will not cause the explosion of azides and other sensitive materials. It will produce changes which affect the subsequent decomposition. (J.S.R.)

14333

THE EFFECT OF NUCLEAR RADIATION ON EXPLOSIVES. J. V. R. Kaufman (Picatinny Arsenal,

Dover, N. J.). Proc. Roy. Soc. (London) A246, 219-25 (1958) July 29.

The results of a study to determine the relative resistance of a number of explosives to effects of low-energy γ rays is presented. The data obtained from irradiating the materials at several temperatures by the 0.41 Mev γ quantum emitted by Au^{198} demonstrate that no obvious correlation exists between the radiation resistance of explosives and their thermal stability, mechanical sensitivity, or ignition temperature. In view of their well-known explosive behavior, the resistance of explosives to irradiation decomposition is surprising. In some cases chemical instability during irradiation is detectable with difficulty even at doses of 10^6 r. It is evident from the data as well, that the chemical structures in question exhibit a varied resistance to radiation effects and suggest that resonance properties of certain molecules contribute markedly to radiation resistance. (auth)

14334

THE EFFECT OF HIGH ENERGY X-RAYS AND PILE RADIATION ON THE THERMAL DECOMPOSITION AND THERMAL EXPLOSION OF α-LEAD AZIDE. J. M. Groocock (Ministry of Supply, Armament Research and Development Establishment). Proc. Roy. Soc. (London) A246, 225-32(1958) July 29.

α-lead azide was irradiated in air with the x rays from 1 Mv generator and with pile radiation. At dosages below 10^4 r the thermal decomposition and thermal explosion characteristics of the x-irradiated material are indistinguishable from those of the unirradiated material. At higher dosages decomposition rates are changed and explosion times reduced. Pile radiation gives very similar results for the same energy deposition. Samples irradiated at 10^4 and 10^7 r showed no difference from unirradiated material on a friction sensitivity test. (auth)

Radioactivity

Refer also to abstract 14443.

14335 USNRDL-TR-237

Naval Radiological Defense Lab., San Francisco. EXPERIMENTAL INVESTIGATION OF THICK TARGET BREMSSTRAHLUNG RADIATION FROM ELECTRONS OF 1.00, 1.50, AND 2.00 MEV. E. A. Edelsack, W. E. Kreger, W. Mallet, and N. E. Scofield. May 27, 1958. 51p.

The 2.0-Mev Van de Graaff accelerator facility at USNRDL has been used as a source of high-intensity x radiation for a large number of experiments over the past several years. In order to explore the feasibility of using this radiation source in an even wider variety of situations, it was considered necessary to determine the exact spectrum of bremsstrahlung produced by the bombardment of thick metallic targets by the monoenergetic electrons accelerated in the Van de Graaff. While a gold target is usually used as the bremsstrahlung target for high-intensity work, it was decided to explore the bremsstrahlung emerging from targets having a wide range of Z values, thus providing a more widely usable fund of information. Thus, the experiment described in this report consisted of the measurement of the 0° bremsstrahlung spectrum emerging from thick targets of polystyrene, aluminum, copper, silver, and gold bombarded by monoenergetic electrons at 2.0, 1.5, and 1.0 Mev. (auth)

14336

BETA AND GAMMA RAY SPECTROSCOPY OF Co^{60}. Kazumasa Kamada, Tomoyuki Teranishi, and Yasukazu Yoshizawa (Osaka Univ.). J. Phys. Soc. Japan 13, 763-4(1958) July.

Beta-ray and internal conversion electrons of 1.17- and 1.33-Mev gamma rays were measured by the two-directional focusing beta-ray spectrometer. The values obtained are presented in tables and graphs. (J.R.D.)

14337

TRANSITIONS IN Hg^{199} FOLLOWING THE DECAY OF Au^{199}. G. Bäckström, O. Bergman, and J. Burde (Inst. of Physics, Uppsala). Nuclear Phys. 7, 263-75(1958) June (3).

The energies of the three γ lines in Hg^{199} were measured absolutely, using an iron-free double-focusing spectrometer. The atomic binding energy was also absolutely determined. Relative L-subshell conversion intensities were found to yield accurate information on the multipolarity. Relative M-shell conversion coefficients were compared with theory. Partial transition probabilities were computed, and the effect of l-forbiddenness was studied. (auth)

14338

THE HALF-LIVES OF SOME SHORT-LIVED ISOTOPES. M. V. Mihailović and B. Povh (Inst. "J. Stefan," Ljubljana, Yugoslavia). Nuclear Phys. 7, 296(1958) June (3).

The half lives of Mg^{23}, Al^{26}, Si^{27}, S^{31}, Cl^{34}, K^{38}, and Ca^{39} have been measured with better precision than before. The activities were induced by x rays from a 31-Mev betatron. The results are tabulated. (A.C.)

14339

GAMMA RADIATION FOLLOWING THE DECAY OF Mn^{56} AND THE ENERGY LEVELS OF Fe^{56}. C. Sharp Cook (U. S. Naval Radiological Defense Lab., San Francisco). Nuclear Phys. 7, 480-7(1958) July (2).

The gamma radiation following the decay of Mn^{56} has been studied using a 4" diameter by 4" high NaI(Tl) crystal spectrometer. Two new gamma rays at 2.52 and 3.39 Mev have been found. Relative intensities of the gamma-rays are reported. (auth)

14340

BETA DECAY OF N^{13} AND FIERZ INTERFERENCE IN FERMI INTERACTIONS. H. Daniel and U. Schmidt-Rohr (Max-Planck-Institut, Heidelberg, Germany). Nuclear Phys. 7, 516-25(1958) July (2). (In German).

The β-ray spectrum of the mirror transition $N^{13} \rightarrow C^{13}$ has been investigated with an iron-free lens spectrometer. No deviation from the allowed shape was observed. The Fierz coefficient was measured to be $b = (0.14 \pm 2.37)$ % (standard deviation). Taking into account that only 70% of the transition rate are due to Fermi interaction an upper limit of 11% is found for $|b_F|$, b_F being the Fierz coefficient for pure Fermi interaction. (auth)

14341

POLARIZATION MEASUREMENTS OF GAMMA RADIATION FROM SULPHUR-34. G. G. Shute and P. S. Fisher (Univ. of Birmingham, Eng.). Phil. Mag. (8) 3, 726-37(1958) July.

Polarization measurements have been made on the gamma cascade in S^{34}. The experimental results are consistent with a spin sequence 2^+, 2^+, 0^+ with a mixture of M1 and 1.5% of E2 in the first transition. The theoretical analysis of polarization-direction correlations with mixing included is discussed in some detail. Shell model assignments for the gamma cascade are

given with possible explanations of the mixing ratio value obtained. (auth)

14342

POLARIZATION OF POSITRONS FROM Ga^{66}, Ga^{68}, P^{29}, AND Al^{25}. R. S. Preston and S. S. Hanna (Argonne National Lab., Lemont, Ill.). Phys. Rev. 110, 1406-8 (1958) June 15.

The longitudinal polarizations of thermalized positrons from Ga^{66}, Ga^{68}, P^{29}, and Al^{25} have been observed from measurements on annihilation with polarized electrons in a magnetic medium. When allowance is made for the depolarization suffered by the positrons in coming to rest, the observations are in qualitative agreement with the assumption that the initial polarizations are proportional to +v/c with the same proportionality constant as for positrons from Cu^{64}. (auth)

14343

HALF-LIFE OF K^{37}. Felix Schweizer (Univ. of California, Los Angeles). Phys. Rev. 110, 1414-15(1958) June 15.

A more accurate value of the half life of K^{37} is 1.23 ± 0.02 seconds, in agreement with the value reported by Sun and Wright. The Gamow-Teller matrix elements is recalculated using new values of the coupling constants, and is found to be in agreement with the theoretical value calculated by Winther and Kofoed-Hansen from the shell model. The experimental method is described in detail. (auth)

14344

DECAY OF Er^{171}. F. P. Cranston, Jr., M. E. Bunker, and J. W. Starner (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 110, 1427-38(1958) June 15.

The decay of Er^{171} (7.52 hours) has been studied with beta- and gamma-scintillation spectrometers, a magnetic lens spectrometer, and a 180° permanent-magnet spectrograph. A number of previously unobserved beta-ray and gamma-ray transitions were found. On the basis of coincidence studies, intensity data, internal conversion coefficients, and the measured transition energies, a consistent level scheme for Tm^{171} is proposed which has excited states at energies of 0.0051, 0.1167, 0.1291, 0.4251, 0.636, 0.688, 0.744, 0.921, and 1.008 Mev. The observed states are identified with appropriate orbitals of the Nilsson energy level diagram, and the experimental transition probabilities are examined in terms of the asymptotic selection rules for strongly deformed nuclei. (auth)

14345

PRECISION MEASUREMENTS OF THE HALF-LIVES OF THE POSITON EMITTERS ^{25}Al, $^{26}Al^{m}$, AND ^{33}Cl. Th. Muller, E. S. Gelsema, and P. M. Endt (Fysich Laboratorium der Rijksuniversiteit te Utrecht, Netherlands). Physica 24, 577-83(1958) July.

The half lives of the positron emitters Al^{25}, Al^{26m}, and Cl^{33}, produced by (p,γ) reactions at selected resonances, have been measured by means of two different methods: (a) with a 70-channel pulse-analyzer using time-to-pulse-height conversion; (b) with an eleven-contact stepping switch and eleven sets of scales and mechanical registers. The results are: Al^{25}, 7.24 ± 0.03 sec; Al^{26m}, 6.28 ± 0.04 sec; Cl^{33}, 2.53 ± 0.02 sec. (auth)

14346

CONTRIBUTION TO THE DECAY THEORY OF A QUASI-STATIONARY STATE. L. A. Khalfin. Soviet Phys. JETP 6, 1053-63(1958) June.

Some general problems relating to the decay theory of a quasi-stationary state are considered. Dispersion relations are derived on the basis of the semi-finiteness of the energy distribution density ω(E). A criterion of physical feasibility in decay theory is formulated and studied on the basis of the Paily and Wiener theorem. It is shown that an exponential decay law cannot hold for all Γt/ħ. Corrections to the exponential decay law are computed under the simplest assumptions. Dispersion relations between the modulus and the phase of the function p(t) are derived and investigated. On the basis of a knowledge of the decay law, these allow a determination of the energy distribution density ω(E) analytically. The results obtained are derived from the general laws of quantum mechanics and do not depend on the model of the decaying system. (auth)

Rare Earths and Rare-earth Compounds

14347

ELECTRON SPIN RESONANCE OF Eu^{++} IN NATURAL CaF_2. On Matumura, Kazumi Hōrai, and Zen'emon Miduno (Kyusyu Univ., Japan). J. Phys. Soc. Japan 13, 768-9(1958) July.

The electron spin resonance of CaF_2 crystals containing a small amount of Eu^{2+} was analyzed at 3 cm wavelength at room temperature. The spectrum and calculations for resonance fields are described. (J.R.D.)

14348

MAGNETIC PROPERTIES OF THE Gd–La AND Gd–Y ALLOYS. W. C. Thoburn, S. Legvold, and F. H. Spedding (Iowa State Coll., Ames). Phys. Rev. 110, 1298-1301(1958) June 15.

Magnetic properties of Gd–La and Gd–Y alloys are presented. For alloys of high Gd content, paramagnetic to ferromagnetic transitions are observed with decreasing temperature. As the Gd content is decreased, ferromagnetic ordering is replaced by antiferromagnetic ordering. In the Gd–La alloys, a crystal structure change affects the magnetic properties. (auth)

14349

FERROMAGNETIC RESONANCE LINE WIDTH IN YTTRIUM IRON GARNET SINGLE CRYSTALS. R. C. LeCraw, E. G. Spencer, and C. S. Porter (Diamond Ordnance Fuze Labs., Washington, D. C.). Phys. Rev. 110, 1311-13(1958) June 15.

A study of ferromagnetic resonance line width in polished, single-crystal spheres of yttrium iron garnet is described. Wave-guide cavity perturbation techniques are used with samples 0.013 in. to 0.020 in. in diameter. An extremely narrow line width of 520 millioersteds (the full width) is observed at 9300 Mc/sec along the hard axis [100]. It is believed this is the narrowest resonance line yet reported on ferromagnetic materials. The line width is shown to be strongly influenced by the sample surface, with the line narrowing by over a factor of twenty as the polishing proceeds. The line width at 3000 Mc/sec on the same sample is 530 millioersteds. The approximate invariance of the line width for more than a three-to-one change in frequency is compared with the predictions of some recent theories of ferromagnetic resonance line width. The invariance of line width with frequency is also used to conclude that $\lambda\omega$ and T_2 in the Landau-Lifshitz and Bloch-Bloembergen equations of motion, respectively, are approximately constant over this frequency range. (auth)

14350

ON YTTERBIUM CITRATE COMPLEXES. M. M. Senyavin and A. M. Sorochan. Zhur. Neorg. Khim. 3, 301-8(1958) Feb. (In Russian)

The existence of negatively charged ytterbium com-

plexes was confirmed by the ionic exchange method. The conductometric method for determination of compositions of ytterbium complexes with citric acid produced a negative result. The composition and stability of ytterbium citrate complexes at various pH (in the pH interval 3 to 6) and various ratios of nitric acid and ytterbium were found by potentiometric titration. It is shown that the instability constant of the complex (Yb $Cit_2)^{3-}$ equals 1×10^{-6}; the ratio of instability constants of $(HYbCit_2)^{2-}$ and $(YbCit_2)^{3-}$ equals 10^{-5}. Formation of complexes (YbOH Cit)$^-$, $(Yb(OH)_3Cit)^{3-}$, and (Yb Cit)$^-$ at pH 5 and 6 and with small quantities of citric acid was observed, and tentative data for the magnitude of their constants of instability (10^{-6}, 10^{-36}, and 10^{-8}, respectively) are included. (R.V.J.)

Shielding

14351

SUPPRESSION OF NEUTRON-INDUCED ACTIVATION OUTSIDE A HYDROGENOUS SHIELD. Fritz W. Mezger (General Electric Co., Cincinnati). Nuclear Sci. and Eng. 4, 96-111(1958) July.

Two methods are evaluated for the suppression of neutron-induced activation outside hydrogenous shields: the addition of a 1/v absorber to the hydrogeneous shielding material, and the addition of a layer of 1/v absorbing material to the outside of the shield. When the material being activated has a 1/v cross section, a closed-form solution is obtained. The results should prove valuable in determining to what extent activation outside a shield can be reduced by any combination of these two methods. (auth)

Spectroscopy

14352 AERE-Lib/Trans-778

RESEARCH ON THE BEST CONDITIONS FOR USING A FABRY-PEROT PHOTO-ELECTRIC SPECTROMETER. R. Chabbal. Translated by R. B. Jacobi (U.K.A.E.A. Atomic Energy Research Establishment) from J. recherches centre natl. recherche sci. Lab. Bellevue (Paris), No. 24, 138-86(1953). 99p.

The conditions under which the intensity of a photoelectric interference spectrometer with a given resolution is maximum are discussed. This maximum intensity is an inverse function of the corresponding resolution and is also determined. The study of the instrument is based on the instrument functions the etalon function E, and the scanning function F. The functions representing the profile under examination at the various stages of its transformation are: source function B, at the point of entry into the etalon, function T between the etalon and the scanning system, and recorded function Y. (J.R.D.)

14353 NP-tr-118

ON THE THEORY OF THE BROADENING OF SPECTRAL LINES AS A CONSEQUENCE OF LINEAR STARK EFFECT. V. I. Kogan. Translated by P. Kelly (U.K.A.E.A. Atomic Energy Research Establishment). 14p.

A theoretical treatment of the linear Stark effect is presented. In the theory that is offered the terms of the problem of the broadening of the line contain the following basic simplifying assumptions: a classical description not only of ions but of electrons as well; correlation of the positions of charged particles is neglected; no account is taken of quantum effects in the influence of the changing electric field on the radiating atom. (W.L.H.)

14354

NUCLEON SIZE CONTRIBUTIONS TO THE HYPERFINE STRUCTURE OF HYDROGEN AND HELIUM. A. M. Sessler and R. L. Mills (Ohio State Univ., Columbus). Phys. Rev. 110, 1453-7(1958) June 15.

The effect of the electromagnetic structure of the proton and neutron upon the hyperfine splitting of S states in hydrogen and helium is calculated nonrelativistically. Convenient formulas are given, assuming that the charge and moment distributions of the proton and neutron are Gaussian. A summary of calculations of nuclear structure effects in deuterium is given and the present experimental situation is reviewed. If there is no relativistic or interaction moment contribution to the magnetic moment of the deuteron, the percent D state is 3.9, which is, under the same assumptions, consistent with the hyperfine splitting of deuterium. (auth)

14355

ELECTRON ABSORPTION SPECTROMETER USING AN IMPROVED VELOCITY ANALYZER. L. Marton and J. Arol Simpson (National Bureau of Standards, Washington). Rev. Sci. Instr. 29, 567-70(1958) July.

An electron absorption spectrometer with an improved velocity analyzer using the principle of individually designed stages for deceleration, dispersion, and reacceleration is described. The instrument is usable over an energy range of 1 to 50 kev and can obtain angular distribution data over a range of ±0.1 radian. The angular resolution is better than 10^{-3} radian. The demonstrated energy resolution at 20 kev is 0.6 ev. This resolution appears to be limited by the primary beam energy spread which is characteristic of a beam produced by a telefocus gun with a tungsten cathode. (auth)

14356

EPR SPECTROMETER OF VERY HIGH SENSITIVITY. Harihar Misra (Ravenshaw Coll., Cuttack, India). Rev. Sci. Instr. 29, 590-4(1958) July.

A recording electron paramagnetic resonance absorption spectrometer of very high sensitivity, operating at a wavelength of 3 cm, is described. It is of the reflection-cavity-in-magic-T-bridge type, using a superheterodyne receiver. Its special features are: (1) a two-cavity klystron oscillator with superior frequency stability and more available power; (2) a synchrodyne system to derive local oscillator power, thus avoiding the difficulty of tracking two independent oscillators; (3) a balanced magic-T mixer which considerably reduces the noise output; (4) a double-input low-noise intermediate frequency amplifier at 30 Mc; and (5) a tunable high-Q sample-carrying cavity with an almost identical cavity to balance it in the magic-T bridge. Arrangements for an oscilloscopic display of the absorption vs. magnetic field and a continuous recording of the derivative of absorption vs. magnetic field have been incorporated. Sensitivity of the microwave bridge system and of the spectrometer have been tested. About 1.1×10^{-11} mole of diphenyl picryl hydrazyl dissolved in purified benzene, which corresponded to approximately 1.06×10^{-14} mole of crystalline sample, has been detected by the spectrometer. (auth)

14357

RECENT DETERMINATIONS OF ATOMIC MASS RATIOS BY MICROWAVE SPECTROSCOPY. B. Rosenblum and C. H. Townes (Columbia Univ., New York), and

S. Geschwind (Bell Telephone Labs., Inc., Murray Hill, N. J.). Revs. Modern Phys. 30, 409-11(1958) Apr.

The principal advances in determination of nuclear masses by microwave spectroscopy during the past several years have come from examination of diatomic molecules. A precise and critical examination of various small corrections to mass measurements has been made in the CO molecule. From this the validity of the molecular theory involved has been confirmed to very high accuracy, and precise values of mass ratios of C and O isotopes have been obtained. (W.D.M.)

Theoretical Physics

14358 AFOSR-TN-58-631
Maryland. Univ., College Park.
NOTE ON THE FORMULATION OF THE CAUSALITY REQUIREMENT. Physics Department Technical Report No. 110. John G. Taylor and John S. Toll. [1958]. 13p. Contract AF49(638)-24. (AD-162161).

Segal's recent formulation of the causality requirement is considered. This formulation is shown to differ in important respects from the usual requirement of "no output before input," and certain difficulties of physical interpretation are discussed. Segal's formulation is shown to be more restrictive than the usual strict causality and to exclude bound states and certain types of resonances that occur in theories of physical interest. The discussion of the Klein-Gordon wave in terms of the characteristic momentum variable is analyzed further and the way in which Segal's formulation extends the domain of analyticity is described. (auth)

14359 IFA-FT-28
Academia R. P. R. Institutul de Fizică Atomică, Bucharest.
ON THE REDUCTION OF THE γ_A SPACE. (Asupra Reducerii Spatiului γ_A.) S. Ciully. 1958. 10p.

An attempt is made to give a simple practical form to the procedure of reducing the sixteen initial γ_A-units to the four-dimensional basis of the subspace of interest. The final result contains an infinite set of such bases depending parametrically on a time-like vector and having the covariant properties of antisymmetrical second rank tensors. A formula of practical use interconnecting these bases is given. (M.H.R.)

14360 NP-6853
Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.
THE NONANALICITY OF THE NONRELATIVISTIC SCATTERING AMPLITUDE AND THE POTENTIAL. J. A. Smorodinsky. 1958. 5p.

14361 NP-6856
Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.
ELECTRICAL POLARIZABILITY OF THE MESON CLOUD IN A NUCLEON. V. S. Barashenkov and B. M. Barbashov. 1958. 7p.

The first approximation of the Chew theory is used in order to evaluate the magnitude of the electrical polarizability of the meson cloud in the nucleon. (W.D.M.)

14362 NP-6858
Joint Institute for Nuclear Research, Moscow.
AN ALGEBRAIC SYSTEM OF FUNDAMENTAL PARTICLES. V. Votruba and M. Lokajíček. 1958. 50p.

A preliminary systematics based on correspondence between kinds of fundamental particles and pairs of irreducible representations of Dirac's or Duffin-Kemmer's algebra in space-time and in isospace is proposed. An "isoalgebra of stronglys" is defined, and a theory of the unified baryon-field and meson-field is formulated. Strong and weak interactions between these two fields are investigated. An outlook on possibilities of further development of this theory is given. (auth)

14363 NP-6860
Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.
ON THIRRING'S TWO-DIMENSIONAL MODEL. M. E. Mayer and D. V. Shirkov. Apr. 1958. 16p.

The diagram with four external lines in a two-dimensional nonlinear fermion theory, analogous to Thirring's model, is calculated to the second order of perturbation theory. It is shown that the corresponding S matrix element contains no ultraviolet divergences and that the coupling constant is not subject to renormalization. An improved expression for the matrix element for the scattering of two particles is obtained by means of the renormalization group method and is very similar to the corresponding exact result of Thirring. (auth)

14364 NP-6864
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
ON THE ELEMENTARY PARTICLES AND THEIR STRONG INTERACTIONS. Report No. 17/VII. W. Królikowski. Mar. 1958. 13p.

A local theory of elementary particles is proposed. Types of fermions following from this theory seem to cover exactly the list of experimental leptons and baryons. The general expressions for the charge and strangeness operators are given. Some preliminary propositions are made for the form of strong interactions. (auth)

14365 NP-6868
Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.
ELECTROMAGNETIC INTERACTION OF ANOMALOUS PARTICLES WITH SPIN 1/2. Ivan Úlehla. 1957. 11p.

It is shown that relativistic wave equations for particles with spin $\frac{1}{2}$ which are different from Dirac equations exist. Particles described by these "anomalous" equations can have one or more self masses, and the corresponding fields have positive definite charge density. The electromagnetic interaction of particles described by the simplest "anomalous" equations is investigated, magnetic moment, cross sections for Coulomb and Compton scattering, and self-energy are determined. All these quantities differ from analogous expressions for electrons. (auth)

14366 NP-6880
Joint Inst. for Nuclear Research, Moscow. Lab. of Theoretical Physics.
REMARKS ON THE MEASURABILITY OF ELECTROMAGNETIC FIELDS. G. Heber. 1957. 14p.

Indeterminacy relations are derived which express the fact that only 4-dimensional averages of electromagnetic fields are measurable and that also an average cannot be measured with unlimited accuracy simultaneously with the position of the averaging region in space-time continuum. Test bodies were used which obey Heisenberg's indeterminacy relations and possess a finite extension, finite mass and finite electric charge. (auth)

14367 NP-6888
Joint Inst. for Nuclear Research, Moscow. Lab. of Nuclear Problems.
INVERSE β-PROCESSES AND NON-CONSERVATION

OF LEPTON CHARGE. Bruno M. Pontecorvo. 1957. 7p.

The possibility of real transitions neutrino → antineutrino in vacuum, provided that the lepton charge is not conserved, is considered in some detail. (W.D.M.)

14368 NYO-2051

Johns Hopkins Univ., Baltimore.

A WAVE VECTOR TECHNIQUE FOR THE ANALYSIS OF DIRECT INTERACTIONS. George E. Owen and L. Madansky. July 1957. 17p. Contract AT(30-1)-2028. $3.30(ph OTS); $2.40(mf OTS).

A simple technique is developed by means of which one can compute the various components of the differential cross section for direct interactions. The method for the most part relies upon the identification of the relative motion wave vectors in a wave vector diagram. By assigning a Fourier transform to each relative motion wave vector, the basic functions representing the differential cross section for stripping reactions, pickup reactions, etc., are obtained. (auth)

14369 NP-tr-122

SOLUTION OF ELECTRODYNAMIC PROBLEMS BY MEANS OF KNOWN SOLUTIONS OF CORRESPONDING ELECTROSTATIC AND MAGNETOSTATIC PROBLEMS. A. I. Potekhin. Translated by Morris D. Friedman (Lincoln Lab., MIT) from Radiotekh. i Elektron. 3, 587-91(1958). 8p.

A method is proposed for finding the solutions of certain electrodynamic boundary problems by means of known solutions of corresponding electrostatic or magnetostatic problems. The solution is expressed in terms of Hankel functions of fractional index. The method is applicable in those cases when the dependence of the field intensity on the angular coördinates does not vary with frequency. (auth)

14370

A CLASS OF SELF-SUSTAINING DISSIPATIVE SPHERICAL DYNAMOS. George Backus (Princeton Univ., N. J.). Ann. Phys. (N. Y.) 4, 372-447(1958) Aug.

The dynamo equations describing the effects of the internal motion of a bounded volume of incompressible fluid with nonzero ohmic resistivity on the magnetic field produced by electric currents in that fluid are rigorously treated. The procedure involves representing an arbitrary solenoidal vector field in terms of two scalars, analogous to the representation of an arbitrary irrotational field as the gradient of a single scalar. The dynamo equations are reduced to scalar heat equations for the two field scalars, the coupling between them taking the form of a heat source term. Precise results about the magnetic field can be obtained from these heat equations with the help of several variational inequalities analogous to Rayleigh's variational estimate for the fundamental frequency of a vibrating system. The main result is the explicit construction of a large class of continuously differentiable fluid velocities capable of indefinitely maintaining or amplifying the dipole moment of the external magnetic field. A critique of some previous attempts to produce dissipative self-regenerative spherical dynamos is included. The techniques which lead to the existence of self-sustaining dynamos produce other results about the dynamo equations. These results are listed. (auth)

14371

A WAVE EQUATION FOR A PARTICLE OF MAXIMUM SPIN ONE. Herman Feshbach and William Nichols (Massachusetts Inst. of Tech., Cambridge). Ann. Phys. (N. Y.) 4, 448-58(1958) Aug.

A general, first-order, linear, relativistic wave equation for a particle of arbitrary half-integral maximum spin is presented. The structure of the general theory is described briefly, while its specialization to a particle of maximum spin one is treated at greater length. The special theory describes not only the simple scalar (S), pseudoscalar (P), vector (V), and axial-vector (A) mesons, but also composite "particles" possessing S, P, V, and A components, all components differing in rest mass. The restriction to unique rest mass allows the wave function to satisfy the Klein-Gordon equation. The restriction to a positive-definite energy density eliminates all composite particles except the S-P, the S-A, and the P-V. The theory is invariant under the extended Lorentz group, charge conjugation, and Hermitian conjugation. (auth)

14372

DISPERSION RELATIONS FOR REACTIONS INVOLVING A VARIABLE NUMBER OF PARTICLES. A. A. Logunov (Joint Inst. of Nuclear Studies). Doklady Akad. Nauk S.S.S.R. 120, 501-3(1958) May 21. (In Russian)

The process $\gamma + p + 2\gamma + p$ was utilized in studies of the theory of dispersion relations involving a variable number of particles. The studies included only the principle term of the amplitude; the electromagnetic corrections of high order were not considered. The results can be applied to other reactions. (R.V.J.)

14373

THEORY OF SYSTEMS WITH NON-CENTRALIZED INTERACTIONS OF PARTICLES. A. E. Glauberman (Ivan Franco L'vov State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 254-9(1958) Mar. (In Russian)

The general theory of particle interaction systems, where in addition to the central interaction the oriented interaction is of importance, is described on the basis of the Bogolyubov method adapted for such systems. (R.V.J.)

14374

RIGHT-LEFT ASYMMETRY AND TWO-COMPONENT NEUTRINO. T. Takabayasi (Institut Henri Poincaré, Paris). Nuclear Phys. 7, 237-50(1958) June (3).

The two-component neutrino theory is formulated irrespectively of the handedness of the coördinate frame. This is made possible by introducing a constant pseudoscalar η_f and by ascribing the two-component spinor slightly new transformation properties under Lorentz transformations. The method automatically exhibits the reflection properties of the various physical quantities of the system and eliminates some confusing inconveniences of the current theory, which restricts one to either right-handed or left-handed coördinate frame. It is emphasized that η_f is an effective instrument in specifying the description of any objectively right-left asymmetrical process. (auth)

14375

A REPRESENTATION OF THE ISOBARIC SPIN OF PARTICLES IN STRONG INTERACTIONS. D. Ruelle (Universite Libre de Brussels). Nuclear Phys. 7, 443-50(1958) July (2). (In French).

The behavior of all known particles in isobaric spin space is represented by 2×2 matrices or "quaternions." In particular an isospin-zero particle introduced by d'Espagnat and Prentki and others disappears from the Lagrangian of the strong interactions as a consequence of invariance under charge conjugation. This representation gives a simple form to the isospin, charge, and isofermion number as infinitesimal operators. Although not irreducible when only rotations in isospin space and charge-conserving gauge transforma-

tions are considered, it may prove useful in the study of very strong or weak interactions. (auth)

14376

THE DETERMINATION OF THE FUNDAMENTAL STATE OF A SYSTEM OF PARTICLES. Claude Bloch (Centre d'Études Nucléaires de Saclay, Gif-sur-Yvette, France). Nuclear Phys. 7, 451-8(1958) July (2). (In French).

The linked diagram expansions of the ground state energy and wave function of a system of particles are derived by a method involving the use of the time-dependent as well as the time-independent formulations of perturbation theory. The essential step is the derivation, in the time-dependent formulation, of a simple exponential formula obtained by summation of the disconnected vacuum-vacuum diagrams. (auth)

14377

A DEVELOPMENT OF THE GIBBS POTENTIAL OF A QUANTIC SYSTEM COMPOSED OF A LARGE NUMBER OF PARTICLES. Claude Bloch and Cyrano De Dominicis (Centre d'Etudes Nucléaires de Saclay, Gif-sur-Yvette, France). Nuclear Phys. 7, 459-79(1958) July (2). (In French).

The Gibbs potential is expressed as an expansion in terms of linked diagrams. In the limit of zero temperature, it reduces to the Goldstone expansion for the ground state energy. At a finite temperature, the only difference with the latter comes from temperature dependent weight factors associated with every line of the diagrams. For a fermion particle (hole) line, the weight factor is given by the probability of the corresponding state being empty (occupied) in the independent particle gas at the given temperature. The general case of a system of interacting bosons and fermions is treated. Wick's theorem has been extended to the expectation value of a product of operators for a system of independent particles at a given temperature. (auth)

14378

SIMPLIFIED DERIVATION OF THE BINARY COLLISION EXPANSION AND ITS CONNECTION WITH THE SCATTERING OPERATOR EXPANSION. A. J. F. Siegert and Ei Teramoto (Northwestern Univ., Evanston, Ill.). Phys. Rev. 110, 1232-4(1958) June 15.

The binary collision expansion for the density matrix of a system of N particles with pair interaction was derived by Huang, Lee, and Yang by expansion in the interaction and subsequent summation over terms represented by certain classes of diagrams. A simpler derivation has been obtained by the use of the $N(N-1)/2$ integral equations which relate the density matrix of the system to the density matrices of systems in which only one pair of particles interacts. Successive substitution of the integral equations into each other yields an expansion which by a trivial additional step becomes the binary collision expansion. Our derivation shows also that the binary collision expansion is the Laplace inverse of the coordinate representation of the expansion in terms of scattering operators. (auth)

14379

CONNECTION BETWEEN SPIN AND STATISTICS. Gerhart Lüders (Max-Planck-Institut fur Physik, Gottingen, Germany). Phys. Rev. 110, 1450-3(1958) June 15.

The proof of the connection between spin and statistics for interacting fields is divided into two parts: commutation relations involving components of a single field, and commutation relations between different fields. The first problem is treated in this paper: the connection between spin and statistics is shown to follow from a few simple postulates. The explicit discussion is limited to the cases of spin zero and of spin one-half. (auth)

14380

CONSERVED CURRENTS IN THE THEORY OF FERMI INTERACTIONS. M. L. Goldberger and S. B. Treiman (Princeton Univ., N. J.). Phys. Rev. 110, 1478-9(1958) June 15.

14381

QUASI-PARTICLES IN MODERN PHYSICS. I. M. Lifshitz (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR (Kharkov). Priroda No. 5, 11-20(1958) May. (In Russian)

A review is given of the characteristics and concepts of quasiparticles in quantum physics. (R.V.J.)

14382

SOME PROBLEMS OF MAGNETOGASDYNAMICS WITH ACCOUNT OF FINITE CONDUCTIVITY. G. S. Golitsyn and K. P. Staniukovich (Moscow State Univ.). Soviet Phys. JETP 6, 1090-9(1958) June.

It is shown that if finite conductivity is taken into account, the equations of magnetogasdynamics become parabolically degenerate. The set of equations is replaced by an approximate but completely hyperbolic set, for which the characteristics are found. It is shown that the equations of a stationary one-dimensional flow have a singularity where the flow velocity is equal to the local sound velocity. Conditions of the transition of the flow velocity through this critical value under the action of a magnetic field have been studied. Small oscillations in a conducting medium, shock waves, and the structure of the shock are investigated. (auth)

14383

CONNECTION BETWEEN THE HULTHÉN AND KOHN METHODS IN COLLISION THEORY. Iu. N. Demkov and F. P. Shepelenko (Leningrad State Univ.). Soviet Phys. JETP 6, 1144-7(1958) June.

Various possible direct variational methods for the determination of the phase shifts of the radial wave function are considered. It is shown that the most natural criterion of the quality of the trial function is the condition of the consistency of the equations. The comparison of the phase-shift results obtained by the Hulthén and Kohn methods, and the verification of whether the integral identity is satisfied, are not independent criteria and in fact reduce to the consistency condition. It is also shown how the correct value can be chosen from two phase-shift values obtained by the Hulthén method, without resorting to comparison with the results of other methods. (auth)

14384

ELECTROMAGNETIC INTERACTION WITH PARITY VIOLATION. Ia. B. Zel'dovich. Soviet Phys. JETP 6, 1184-6(1958) June.

14385

QUANTUM MECHANICS, NON-RELATIVISTIC THEORY. VOLUME 3 OF COURSE OF THEORETICAL PHYSICS. L. D. Landau and E. M. Lifshitz. Translated from the Russian by J. B. Sykes and J. S. Bell. Reading, Mass., Addison-Wesley Publishing Company, Inc., London, Pergammon Press Ltd., 1958. 526p.

Non-relativistic quantum mechanics is treated in such a way that the physical significance of the theory is exhibited and then the mathematical formalism is built up. The material is presented in chapters on basic concepts, energy and momentum, Shroedinger's equation, angular momentum, motion in a centrally symmetric field, perturbation theory, the quasi-classical case, spin, identity of particles, the atom, the diatomic mole-

cule, the theory of symmetry, polyatomic molecules, theory of elastic collisions, theory of inelastic collisions, and motion in a magnetic field. (T.R.H.)

Tracer Applications

14386 SCTM-181-58(16)
Sandia Corp., Albuquerque, N. Mex.
THE PENETRATION OF PRINTED CIRCUIT BOARDS BY ETCHING SOLUTION. A. N. Tschaeche. June 12, 1958. 19p. Contract AT(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

The penetration of etching solution into the unfinished edges of printed circuit boards $\frac{1}{16}$-inch thick was studied using radioisotope tracer techniques. It was found that the etchant, in this case ferric chloride, penetrated boards with the following types of insulation to a depth of about $\frac{1}{8}$ inch: glass epoxy, glass melamine, paper phenolic, and nylon phenolic. Boards using glass silicone insulation were penetrated to a depth of at least $\frac{1}{2}$ inch. Very little, if any, further penetration occurred after the boards were removed from the etchant. The amount of etchant penetrating the first $\frac{1}{8}$ inch of the boards varied from 2.50×10^{-6} grams of $FeCl_3$ per inch of exposed edge in the case of glass-epoxy insulation to 260×10^{-6} grams of $FeCl_3$ per inch of exposed edge in the case of glass-melamine insulation. (auth)

Uranium and Uranium Compounds

14387
COMPOSITION OF PRODUCTS FORMED BY THERMAL NEUTRON FISSION OF ^{235}U. II. CHEMICAL COMPOSITION OF STABLE AND RADIOACTIVE FISSION PRODUCTS. Jan Prawitz and Jan Rydberg (Research Inst. of National Defence, Sundbyberg, Sweden). Acta Chem. Scand. 12, 377-98(1958).

The chemical composition of stable and radioactive fission products has been calculated for seven different irradiation times between 1 day and 2 years, and for three different neutron fluxes, 10^{12}, 10^{13}, and 10^{14} n/cm sec. The results are given in the form of curves showing the β activity and mole fraction of each element as a function of cooling time from 1 day up to about 15 years. The calculations are based on nuclear data published before July 1957. (auth)

14388
THE CONDITIONS FOR REGENERATION OF SINGLE CRYSTALS OF α URANIUM, CONTAINING TRACES OF IMPURITIES, AFTER STAYING FOR SEVERAL HOURS IN β PHASE. Gérard Donze and René Faivre. Compt. rend. 246, 3619-21(1958) June 30. (In French)

The phenomenon of regeneration by conservation of the nucleus was observed in uranium. The effect of carbon content and the degree of overheating in the β phase on the temperature and the speed of the $\beta \rightarrow \alpha$ transformation was determined. Because of the dilation anisotropy of α uranium, the regeneration could be observed easily on the thermodilatometric analysis curves. (J.S.R.)

PATENTS

Chemistry

14389
METHOD OF COATING SURFACES WITH BORON. G. R. Martin (to U. S. Atomic Energy Commission). U. S. Patent 2,484,519. Oct. 11, 1949.

A method of forming a thin coating of boron on metallic, glass, or other surfaces is described. The method comprises heating the article to be coated to a temperature of about 550°C in an evacuated chamber and passing trimethyl boron, triethyl boron, or tripropyl boron in the vapor phase and under reduced pressure into contact with the heated surface causing boron to be deposited in a thin film.

14390
BALANCE. H. Carmichael (to U. S. Atomic Energy Commission). U. S. Patent 2,624,564. Jan. 6, 1953.

A torsional-type analytical balance designed to arrive at its equilibrium point more quickly than previous balances is described. In order to prevent external heat sources creating air currents inside the balance casing that would retard the attainment of equilibrium conditions, a relatively thick casing shaped as an inverted U is placed over the load support arms and the balance beam. This casing is of a metal of good thermal conductivity characteristics, such as copper or aluminum, in order that heat applied to one portion of the balance is quickly conducted to all other sensitive areas, thus effectively preventing the formation of air currents caused by unequal heating of the balance.

14391
SEPARATION PROCESS FOR TRANSURANIC ELEMENT AND COMPOUNDS THEREOF. Lawrence B. Magnusson (to U. S. Atomic Energy Commission). U. S. Patent 2,830,066. Apr. 8, 1958.

A process is described for the separation of neptunium, from aqueous solutions of neptunium, plutonium, uranium, and fission products. This separation from an acidic aqueous solution of a tetravalent neptunium can be made by contacting the solution with a certain type of chelating agent, preferably dissolved in an organic solvent, to form a neptunium chelate compound. When the organic solvent is present, the neptunium chelate compound is extracted; otherwise, it precipitates from the aqueous solution and is separated by any suitable means. The chelating agent is a fluorinated β-diketone, such as trifluoroacetyl acetone.

14392
URANIUM RECOVERY PROCESS. D. Kaufman (to U. S. Atomic Energy Commission). U. S. Patent 2,830,871. Apr. 15, 1958.

A process of recovering uranium from very low-grade ore residues is described. These low-grade uranium-containing hydroxide precipitates, which also contain hydrated silica and iron and aluminum hydroxides, are subjected to multiple leachings with aqueous solutions of sodium carbonate at a pH of at least 9. This leaching serves to selectively extract the uranium from the precipitate, but to leave the greater part of the silica, iron, and aluminum with the residue. The uranium is then separated from the leach liquor by the addition of an acid in sufficient amount to destroy the carbonate followed by the addition of ammonia to precipitate uranium as ammonium diuranate.

14393
FLUORIDE VOLATILITY PROCESS FOR THE RECOVERY OF URANIUM. Joseph J. Katz, H. H. Hyman, and Irving Sheft (to U. S. Atomic Energy Commission). U. S. Patent 2,830,873. Apr. 15, 1958.

The separation and recovery of uranium from contaminants introduced by neutron irradiation by a halogenation and volatilization method are described. The irradiated uranium is dissolved in bromine trifluoride in

the liquid phase. The uranium is converted to the BrF_3 soluble uranium hexafluoride compound whereas the fluorides of certain contaminating elements are insoluble in liquid BrF_3, and the reaction rate of the BrF_3 with certain other solid uranium contaminants is sufficiently slower than the reaction rate with uranium that substantial portions of these contaminating elements will remain as solids. These solids are then separated from the solution by a distillation, filtration, or centrifugation step. The uranium hexafluoride is then separated from the balance of the impurities and solvent by one or more distillations.

14394

ION EXCHANGE PROCESS FOR THE RECOVERY AND PURIFICATION OF MATERIALS. R. S. Long and R. H. Bailes (to U. S. Atomic Energy Commission). U. S. Patent 2,830,874. Apr. 15, 1958.

A process for the recovery of certain metallic ions from aqueous solutions by ion exchange techniques is described. It is applicable to elements such as vanadium, chromium, manganese, and the like, which are capable of forming lower valent cations soluble in aqueous solutions and which also form higher valent anions soluble in aqueous acidic solutions. For example, small amounts of vanadium occurring in phosphoric acid prepared from phosphate rock may be recovered by reducing the vanadium to a trivalent cation adsorbing the vanadium in a cationic exchange resin, then treating the resin with a suitable oxidizing agent to convert the adsorbed vanadium to a higher valent state, and finally eluting the vanadium as an anion from the resin by means of an aqueous acidic solution.

14395

PROCESS OF SEPARATING PLUTONIUM VALUES BY ELECTRODEPOSITION. A. C. Whal (to U. S. Atomic Energy Commission). U. S. Patent 2,830,939. Apr. 15, 1958.

A process is described of separating plutonium values from an aqueous solution by electrodeposition. The process consists of subjecting an aqueous 0.1 to 1.0 N nitric acid solution containing plutonium ions to electrolysis between inert metallic electrodes. A current density of one milliampere to one ampere per square centimeter of cathode surface and a temperature between 10 and 60°C are maintained. Plutonium is electrodeposited on the cathode surface and recovered.

14396

SEPARATING PROTOACTINIUM WITH MANGANESE DIOXIDE. G. T. Seaborg, J. W. Gofman, and R. W. Stoughton (to U. S. Atomic Energy Commission). U. S. Patent 2,831,750. Apr. 22, 1958.

The preparation of U^{233} and an improved method for isolating Pa^{233} from foreign products present in neutron-irradiated thorium is described. The method comprises forming a solution of neutron-irradiated thorium together with a manganous salt, then adding potassium permanganate to precipitate the manganese as manganese dioxide whereby protoactinium is carried down with the manganese dioxide dissolving the precipitate, adding a soluble zirconium salt, and adding phosphate ion to precipitate zirconium phosphate whereby protoactinium is then carried down with the zirconium phosphate to effect a further concentration.

14397

PROCESS FOR SEPARATION OF HEAVY METALS. R. B. Duffield (to U. S. Atomic Energy Commission). U. S. Patent 2,832,793. Apr. 29, 1958.

A method is described for separating plutonium from aqueous acidic solutions of neutron-irradiated uranium and the impurities associated therewith. The separation is effected by adding, to the solution containing hexavalent uranium and plutonium, acetate ions and the ions of an alkali metal and those of a divalent metal and thus forming a complex plutonium acetate salt which is carried by the corresponding complex of uranium, such as sodium magnesium uranyl acetate. The plutonium may be separated from the precipitated salt by taking the same back into solution, reducing the plutonium to a lower valent state on reprecipitating the sodium magnesium uranyl salt, removing the latter, and then carrying the plutonium from the solution by means of lanthanum fluoride.

14398

SEPARATION OF URANIUM FROM ZIRCONIUM AND NIOBIUM BY SOLVENT EXTRACTION. E. E. Voiland (to U. S. Atomic Energy Commission). U. S. Patent 2,833,616. May 6, 1958.

A process for separation of the uranium from zirconium and/or niobium values contained in 3 to 7M aqueous nitric acid solutions is described. This is accomplished by adding phosphoric acid anions to the nitric acid solution containing the uranium, zirconium, and/or niobium in an amount sufficient to make the solution 0.05 to 0.2M in phosphate ion and contacting the solution with an organic water-immiscible solvent such as MEK, whereby the uranyl values are taken up by the extract phase while the zirconium and niobium preferentially remain in the aqueous raffinate.

14399

FLUORINE PROCESS FOR SEPARATION OF MATERIALS. G. T. Seaborg and H. S. Brown (to U. S. Atomic Energy Commission). U. S. Patent 2,833,617. May 6, 1958.

A process is described for separating plutonium from neutron-irradiated uranium, which consists of reacting the irradiated uranium mass with HF to form the tetrafluorides of U, Pu, and Np, and then reacting this mixture of tetrafluorides with fluorine at temperature between 140 and 315°C. This causes volatile hexafluorides of U and Np to form while at the temperature employed the Pu tetrafluoride is unaffected and remains as a residue.

14400

SEPARATING URANIUM CONTAINING SOLIDS SUSPENDED IN A LIQUID. E. C. Creutz and E. P. Wigner (to U. S. Atomic Energy Commission). U. S. Patent 2,833,618. May 6, 1958.

A process is described for separating uranium-containing solids suspended in a liquid. It consists of adding to the liquid a wetting agent for the U-containing solids in an amount sufficient to form a separate liquid phase, the wetting agent having a density greater than the density of the liquid. Ethyl dibromoacetate is noted as one preferred wetting agent.

14401

RECOVERY OF TETRAVALENT CATIONS FROM AQUEOUS SOLUTIONS. R. L. Moore (to U. S. Atomic Energy Commission). U. S. Patent 2,833,799. May 6, 1958.

The recovery of plutonium, zirconium, and tetravalent cerium values from aqueous solutions is described. It consists of adding an alkyl phosphate to a mineral acid aqueous solution containing the metal to be recovered, whereby a precipitate forms with the tetravalent values, and separating the precipitate from the solution. All alkyl phosphates, if water-soluble, are suitable for the process; however, monobutyl phosphate has been found best.

14402

PROCESS FOR PURIFYING PLUTONIUM. D. F. Mastick and E. P. Wigner (to U. S. Atomic Energy Commission). U. S. Patent 2,833,800. May 6, 1958.

A method is described of separating plutonium from small amounts of uranium and other contaminants. An acidic aqueous solution of higher valent plutonium and hexavalent uranium is treated with a soluble iodide to obtain the plutonium in the plus three oxidation state while leaving the uranium in the hexavalent state, adding a soluble oxalate such as oxalic acid, and then separating the insoluble plus the plutonium trioxalate from the solution.

14403

METHOD OF PRODUCING URANIUM. L. S. Foster and T. T. Magel (to U. S. Atomic Energy Commission). U. S. Patent 2,834,672. May 13, 1958.

A modified process is described for the production of uranium metal by means of a bomb reduction of UF_4. Difficulty is sometimes experienced in obtaining complete separation of the uranium from the slag when the process is carried out on a small scale, i.e., for the production of 10 grams of U or less. Complete separation may be obtained by incorporating in the reaction mixture a quantity of $MnCl_2$, so that this compound is reduced along with the UF_4. As a result a U–Mn alloy is formed which has a melting point lower than that of pure U, and consequently the metal remains molten for a longer period allowing more complete separation from the slag.

14404

ELECTROCHEMICAL DECONTAMINATION AND RECOVERY OF URANIUM VALUES. J. A. McLaren and J. H. Goode (to U. S. Atomic Energy Commission). U. S. Patent 2,834,722. May 13, 1958.

An electrochemical process is described for separating uranium from fission products. The method comprises subjecting the mass of uranium to anodic dissolution in an electrolytic cell containing aqueous alkali bicarbonate solution as its electrolyte, thereby promoting a settling from the solution of a solid sludge from about the electrodes and separating the resulting electrolyte solution containing the anodically dissolved uranium from the sludge which contains the rare earth fission products.

14405

REDUCTION OF ACIDITY OF NITRIC ACID SOLUTIONS BY USE OF FORMALDEHYDE. T. V. Healy (to U. S. Atomic Energy Commission). U. S. Patent 2,835,555. May 20, 1958.

A continuous method is described of concentrating by evaporation and reducing the nitrate ion content of an aqueous solution of metallic salts containing nitric acid not in excess of 8N. It consists of heating the solution and then passing formaldehyde into the heated solution to bring about decomposition of the nitric acid. The evolved gases containing NO are contacted countercurrently with an aqueous metal salt solution containing nitric acid in excess of 8N so as to bring about decomposition of the nitric acid and lower the normality to at least 8N, whereupon it is passed into the body of heated solution.

14406

PROCESS OF PREPARING URANIUM-IMPREGNATED GRAPHITE BODY. M. A. Kanter (to U. S. Atomic Energy Commission). U. S. Patent 2,835,608. May 20, 1958.

A method for the fabrication of graphite bodies containing uniformly distributed uranium is described. It consists of impregnating a body of graphite having uniform porosity and low density with an aqueous solution of uranyl nitrate hexahydrate preferably by a vacuum technique, thereafter removing excess aqueous solution from the surface of the graphite, then removing the solvent water from the body under substantially normal atmospheric conditions of temperature and pressure in the presence of a stream of dry inert gas, and finally heating the dry impregnated graphite body in the presence of inert gas at a temperature between 800 and 1400°C to convert the uranyl nitrate hexahydrate to an oxide of uranium.

14407

ISOTOPE FRACTIONATION PROCESS. G. H. Clewett and DeW. A. Lee (to U. S. Atomic Energy Commission). U. S. Patent 2,835,687. May 20, 1958.

A new method is described for isotopic enrichment of uranium. It has been found that when an aqueous acidic solution of ionic tetravalent uranium is contacted with chelate complexed tetravalent uranium, the U^{238} preferentially concentrates in the complexed phase while U^{235} concentrates in the ionic phase. The effect is enhanced when the chelate compound is water insoluble and is dissolved in a water-immiscible organic solvent. Cupferron is one of a number of suitable complexing agents, and chloroform is a suitable organic solvent.

14408

SEPARATION OF PLUTONIUM FROM AQUEOUS SOLUTIONS BY ION-EXCHANGE. Jack Schubert (to U. S. Atomic Energy Commission). U. S. Patent 2,837,401. June 3, 1958.

A process is described for the separation of plutonium from an aqueous solution of a plutonium salt, which comprises adding to the solution an acid of the group consisting of sulfuric acid, phosphoric acid, and oxalic acid, and mixtures thereof to provide an acid concentration between 0.0001 and 1 M, contacting the resultant solution with a synthetic organic anion exchange resin, and separating the aqueous phase and the resin which contains the plutonium.

14409

METHOD OF REDUCING PLUTONIUM COMPOUNDS. I. B. Johns (to U. S. Atomic Energy Commission). U. S. Patent 2,837,402. June 3, 1958.

A method is described for reducing plutonium compounds in aqueous solution from a higher to a lower valence state. This reduction of valence is achieved by treating the aqueous solution of higher valence plutonium compounds with hydrogen in contact with an activated platinum catalyst.

14410

SEPARATION PROCESS USING COMPLEXING AND ADSORPTION. J. H. Spedding and J. A. Ayers (to U. S. Atomic Energy Commission). U. S. Patent 2,837,548. June 3, 1958.

An adsorption process is described for separating plutonium from a solution of neutron-irradiated uranium containing ions of a compound of plutonium and other cations. The method consists of forming a chelate complex compound with plutonium ions in the solution by adding a derivative of 8-hydroxyquinoline, which derivative contains a sulfonic acid group, and adsorbing the remaining cations from the solution on a cation exchange resin, while the complexed plutonium remains in the solution.

14411

OXIDATIVE METHOD OF SEPARATING PLUTONIUM FROM NEPTUNIUM. L. J. Beaufait, Jr. (to U. S.

Atomic Energy Commission). U. S. Patent 2,838,366. June 10, 1958.

A method is described of separating neptunium from plutonium in an aqueous solution containing neptunium and plutonium in valence states not greater than +4. This may be accomplished by contacting the solution with dichromate ions, thus oxidizing the neptunium to a valence state greater than +4 without oxidizing any substantial amount of plutonium, and then forming a carrier precipitate which carries the plutonium from solution, leaving the neptunium behind. A preferred embodiment of this invention covers the use of lanthanum fluoride as the carrier precipitate.

14412

U-EXTRACTION—IMPROVEMENTS IN ELIMINATION OF Mo BY USE OF FERRIC ION. H. M. Clark and D. Duffey (to U. S. Atomic Energy Commission). U. S. Patent 2,838,367. June 10, 1958.

An improved solvent extraction process is described whereby U may be extracted by a water immiscible organic solvent from an aqueous solution of uranyl nitrate. It has been found that Mo in the presence of phosphate ions appears to form a complex with the phosphate which extracts along with the U. This extraction of Mo may be suppressed by providing ferric ion in the solution prior to the extraction step. The ferric ion is preferably provided in the form of ferric nitrate.

14413

TREATMENT OF AMMONIUM NITRATE SOLUTIONS. T. W. Boyer, J. G. MacHutchin, and L. Yaffe (to U. S. Atomic Energy Commission). U. S. Patent 2,838,368. June 10, 1958.

The treatment of waste solutions obtained in the processing of neutron-irradiated uranium containing fission products and ammonium nitrate is described. The object of this process is to provide a method whereby the ammonium nitrate is destroyed and removed from the solution so as to permit subsequent concentration of the solution. In accordance with the process the residual nitrate solutions are treated with an excess of alkyl acid anhydride, such as acetic anhydride. Preferably, the residual nitrate solution is added to an excess of the acetic anhydride at such a rate that external heat is not required. The result of this operation is that the ammonium nitrate and acetic anhydride react to form N_2O and acetic acid.

14414

RECOVERY OF URANIUM AND THORIUM FROM AQUEOUS SOLUTIONS. G. D. Calkins (to U. S. Atomic Energy Commission). U. S. Patent 2,838,370. June 10, 1958.

A process is described for the recovery of uranium and thorium from monazite sand, which is frequently processed by treating it with a hot sodium hydroxide solution whereby a precipitate forms consisting mainly of oxides or hydroxides of the rare earths, thorium and uranium. The precipitate is dissolved in mineral acid, and the acid solution is then neutralized to a pH value of between 5.2 and 6.2 whereby both the uranium and thorium precipitate as the hydroxides, while substantially all the rare earth metal values present remain in the solution. The uranium and thorium can then be separated by dissolving the precipitate in a solution containing a mixture of alkali carbonate and alkali bicarbonate; and contacting the carbonate solution with a strong-base anion exchange resin whereby the uranium values are adsorbed on the resin while the thorium remains in solution.

14415

METHOD OF SEPARATING PLUTONIUM FROM LANTHANUM FLUORIDE CARRIER. G. W. Watt and R. H. Goeckermann (to U. S. Atomic Energy Commission). U. S. Patent 2,838,371. June 10, 1958.

An improvement in oxidation-reduction type methods of separating plutonium from elements associated with it in a neutron-irradiated uranium solution is described. The method relates to the separating of plutonium from lanthanum ions in an aqueous 0.5 to 2.5 N nitric acid solution by treating the solution, at room temperature, with ammonium sulfite in an amount sufficient to reduce the hexavalent plutonium present to a lower valence state, and then treating the solution with H_2O_2 thereby forming a tetravalent plutonium peroxide precipitate.

14416

SOLVENT EXTRACTION PROCESS FOR URANIUM RECOVERY. H. M. Clark and D. Duffey (to U. S. Atomic Energy Commission). U. S. Patent 2,839,357. June 17, 1958.

A process is described for extracting uranium from uranium ore, wherein the uranium is substantially free from molybdenum contamination. In a solvent extraction process for recovering uranium, uranium and molybdenum ions are extracted from the ore with ether under high acidity conditions. The ether phase is then stripped with water at a lower controlled acidity, resaturated with salting materials such as sodium nitrate, and reextracted with the separation of the molybdenum from the uranium without interference from other metals that have been previously extracted.

14417

PROCESS OF RECOVERING URANIUM. T. D. Price and N. M. Jeung (to U. S. Atomic Energy Commission). U. S. Patent 2,839,358. June 17, 1958.

An improved precipitation method is described for the recovery of uranium from aqueous solutions. After removal of all but small amounts of Ni or Cu, and after complexing any iron present, the uranium is separated as the peroxide by adding H_2O_2. The improvement lies in the fact that the addition of H_2O_2 and consequent precipitation are carried out at a temperature below the freezing point of the solution, so that minute crystals of solvent are present as seed crystals for the precipitation.

14418

SEPARATION OF INORGANIC SALTS FROM ORGANIC SOLUTIONS. L. I. Katzin and J. C. Sullivan (to U. S. Atomic Energy Commission). U. S. Patent 2,840,451. June 24, 1958.

A process is described for recovering the nitrates of uranium and plutonium from solution in oxygen-containing organic solvents such as ketones or ethers. The solution of such salts dissolved in an oxygen-containing organic compound is contacted with an ion exchange resin whereby sorption of the entire salt on the resin takes place and then the salt-depleted liquid and the resin are separated from each other. The reaction seems to be based on an anion formation of the entire salt by complexing with the anion of the resin. Strong base or quaternary ammonium type resins can be used successfully in this process.

14419

RECOVERY OF URANIUM FROM PITCHBLENDE. A. E. Ruehle (to U. S. Atomic Energy Commission). U. S. Patent 2,840,452. June 24, 1958.

The decontamination of uranium from molybdenum is described. When acid solutions containing uranyl ni-

trate are contacted with ether for the purpose of extracting the uranium values, complex molybdenum compounds are coextracted with the uranium and also again back-extracted from the ether with the uranium. This invention provides a process for extracting uranium in which coextraction of molybdenum is avoided. It has been found that polyhydric alcohols form complexes with molybdenum which are preferentially water-soluble are taken up by the ether extractant to only a very minor degree. The preferred embodiment of the process uses mannitol, sorbitol or a mixture of the two as the complexing agent.

14420
METHOD OF SEPARATING FISSION PRODUCTS FROM FUSED BISMUTH-CONTAINING URANIUM. R. H. Wiswall (to U. S. Atomic Energy Commission). U. S. Patent 2,840,464. June 24, 1958.

A process is described for removing metal selectively from liquid metal compositions. The method effects separation of fission product metals selectively from dilute solution in fused bismuth, which contains uranium in solution without removal of more than 1% of the uranium. The process comprises contacting the fused bismuth with a fused salt composition consisting of sodium, potassium and lithium chlorides, adding to fused bismuth and molten salt a quantity of bismuth chloride which is stoichiometrically required to convert the fission product metals to be removed to their chlorides which are more stable in the fused salt than in the molten metal and are, therefore, preferentially taken up in the fused salt phase.

14421
PHOTOGRAPHIC FILM DEVELOPER. Francis G. Berry (to U. S. Atomic Energy Commission). U. S. Patent 2,840,471. June 24, 1958.

An improved photographic developer is presented having very high energy development fine grain characteristics and a long shelf life. These characteristics are obtained by the use of aminoacetic acid in the developer, the other constituents of which are: sodium sulfite, hydroquinone, sodium borate, boric acid and potassium bromide, 1-phenyl-3-pyrazolidone.

Engineering

14422
PUMP FOR GASEOUS WORKING FLUIDS. R. Lipscomb (to U. S. Atomic Energy Commission). U. S. Patent 2,456,133. Dec. 14, 1948.

A gas pump having a substantially constant rate of flow and a relatively efficient pumping action is described. A number of flexible plates disposed longitudinally in and in contact with a duct are caused to oscillate transversly so as to produce wave-like deformations of the plates. These deformations are mechanically produced by pushrods and an eccentric gearing arrangement, and are so synchronized that the waves travel from the inlet to the outlet of the duct, and, in so doing, move the gas by positive displacement.

14423
SEALED INSULATOR BUSHING. H. Carmichael (to U. S. Atomic Energy Commission). U. S. Patent 2,617,850. Nov. 11, 1952.

The manufacture of electrode insulators that are mechanically strong, shock-proof, vacuum tight, and are capable of withstanding gas pressures of many atmospheres under intense neutron bombardment, such as may be needed in an ionization chamber, is described. The insulator comprises a bolt within a quartz tube, surrounded by a bushing held in place by two quartz rings, and tightened to a pressure of 1,000 pounds per square inch by a nut and washer. Quartz is the superior material to meet these conditions, however, to withstand this pressure the quartz must be fire polished, lapped to form smooth and parallel surfaces, and again fire polished to form an extremely smooth and fracture resistant mating surface.

14424
TUBE FLANGING APPARATUS HAVING SPIRAL CAM ACTUATED FLANGING ROLLERS. H. J. Bellarts (to U. S. Atomic Energy Commission). U. S. Patent 2,840,136. June 24, 1958.

A tube flaring apparatus designed to roll flawless uniform flanges on tube ends suitable for use in a Van Stone joint is described. Tapered rollers are mounted on gear segments and placed in the end of the tube. The assembly is rotated axially within the tube, and periodically the gear segments are moved by a worm gear so as to force the rollers radially against the tube wall until eventually a perfect 90° flange is formed on the tube. All flanges formed by this machine are uniform, stronger, and have fewer possibilities for leaks than conventional methods heretofore used.

Mineralogy, Metallurgy, and Ceramics

14425
PRODUCTION OF THORIA WARE. P. Murray, I. Denton, and D. Wilkinson (to U. S. Atomic Energy Commission). U. S. Patent 2,807,857. Oct. 1, 1957.

The production of thoria ware of very low porosity by the slip casting of pure thoria is described. It comprises dry milling calcined thoria to obtain particles ranging up to 11 microns in size and having 60% of particles less than 2 microns, forming an aqueous slip of the milled thoric casting the slip and firing the dry cast at a sintering temperature of from 1600 to 1825°C. The preferred composition of the slip is 1600 grams of thoria in each liter of slip. The preferred pH of the slip is 1. When thoria of 99.9% purity is used the slip is suitable for casting for as long as six weeks after preparation.

14426
CENTRIFUGAL CASTING MACHINE. A. B. Shuck (to U. S. Atomic Energy Commission). U. S. Patent 2,829,408. Apr. 8, 1958.

A device is described that is specifically designed to cast uranium fuel rods in a vacuum, in order to obtain flawless, nonoxidized castings which subsequently require a maximum of machining or wastage of the expensive processed material. A chamber surrounded with heating elements is connected to the molds, and the entire apparatus is housed in an airtight container. A charge of uranium is placed in the chamber, heated, then is allowed to flow into the molds while being rotated. Water circulating through passages in the molds chills the casting to form a fine grained fuel rod in nearly finished form.

14427
PRODUCTION OF URANIUM. F. H. Spedding, Harley A. Wilhelm, and Wayne H. Keller (to U. S. Atomic Energy Commission). U. S. Patent 2,830,894. Apr. 15, 1958.

The production of uranium metal by the reduction of uranium tetrafluoride is described. Massive uranium metal of high purity is produced by reacting uranium tetrafluoride with 2 to 20% stoichiometric excess of

magnesium at a temperature sufficient to promote the reaction and then maintaining the reaction mass in a sealed vessel at temperature in the range of 1150 to 2000°C, under a superatomospheric pressure of magnesium for a period of time sufficient to allow separation of liquid uranium and liquid magnesium fluoride into separate layers.

14428

URANIUM ALLOYS. A. U. Seybolt (to U. S. Atomic Energy Commission). U. S. Patent 2,830,896. Apr. 15, 1958.

Uranium alloys containing from 0.1 to 10% by weight, but preferably at least 5%, of either zirconium, niobium, or molybdenum exhibit highly desirable nuclear and structural properties which may be improved by heating the alloy to about 900°C for an extended period of time and then rapidly quenching it.

14429

PRODUCTION OF URANIUM TUBING. E. C. Creutz (to U. S. Atomic Energy Commission). U. S. Patent 2,830,921. Apr. 15, 1958.

The manufacture of thin-walled uranium tubing by the hot-piercing technique is described. Uranium billets are preheated to a temperature above 780°C. The heated billet is fed to a station where it is engaged on its external surface by three convex-surfaced rotating rollers which are set at an angle to the axis of the billet to produce a surface friction force in one direction to force the billet over a piercing mandrel. While being formed around the mandrel and before losing the desired shape, the tube thus formed is cooled by a water spray.

14430

INGOT MOLD. A. J. Mangold, Jr., J. W. MaHaffey, and S. L. Reese (to U. S. Atomic Energy Commission). U. S. Patent 2,832,113. Apr. 29, 1958.

An improved ingot-mold assembly is described, consisting of a body having a cavity and a recess extending through to the bottom of the body from the cavity, and the bottom of the cavity having an internal shoulder extending downward and a plug having an external shoulder. The plug extends above the shoulders and below the bottom of the body.

14431

HOT PRESSING WITH A TEMPERATURE GRADIENT. H. H. Hausner (to U. S. Atomic Energy Commission). U. S. Patent 2,835,573. May 20, 1958.

A method is described for producing powder metal compacts with a high length to width ratio, which are of substantially uniform density. The process consists in arranging a heating coil around the die and providing a temperature gradient along the length of the die with the highest temperature at the point of the compact farthest away from the ram or plunger.

14432

TREATMENT OF METALS PRIOR TO ELECTROPLATING. R. A. U. Huddle and O. Flint (to U. S. Atomic Energy Commission). U. S. Patent 2,835,630. May 20, 1958.

The preparation of certain metal surfaces to receive electrodeposits is described. Surfaces of the metals are subjected to shot blasting by ferrous metal shot, and the surfaces then are given a coating of copper by displacement from a copper salt solution. The method applies to U, Zr, Ti, Ta, Ni, Mo, W, and V.

14433

SURFACE TREATMENT OF METALLIC URANIUM. A. G. Gray and E. W. Schweikher (to U. S. Atomic Energy Commission). U. S. Patent 2,836,548. May 27, 1958.

The treatment of metallic uranium to provide a surface to which adherent electroplates can be applied is described. Metallic uranium is subjected to an etchant treatment in aqueous concentrated hydrochloric acid, and the etched metal is then treated to dissolve the resulting black oxide and/or chloride film without destroying the etched metal surface. The oxide or chloride removal is effected by means of moderately concentrated nitric acid in 3 to 20 seconds.

14434

CORROSION INHIBITION. G. H. Cartledge (to U. S. Atomic Energy Commission). U. S. Patent 2,837,474. June 3, 1958.

The protection of ferrous metals from the corrosive action of aqueous solutions is accomplished by the incorporation of small amounts of certain additive agents into the aqueous solutions. The method comprises providing a small concentration of technetium, in the form of pertechnetate ion, dissolved in the solution.

14435

METHOD OF SOLID STATE WELDING. Samuel Storchheim (to U. S. Atomic Energy Commission). U. S. Patent 2,837,818. July 10, 1958.

An improved method is described for pressure bonding of dissimilar metals, particularly nickel and aluminum. Using ordinary techniques for the pressure bonding of these metals, an alloy zone is usually formed between the metals, and this alloy zone exhibits undesirable brittleness and lack of tensile strength. Formation of this alloy zone can be inhibited or prevented by heating the metals being bonded to a temperature below the melting point of either of the metals and using very high pressures for short periods of time. In this manner a bond is formed without the formation of the undesirable alloy zone.

14436

PROCESS FOR THE CONCENTRATION OF ORES CONTAINING GOLD AND URANIUM. A. M. Gaudin and J. Dasher (to U. S. Atomic Energy Commission). U. S. Patent 2,838,369. June 10, 1958.

A process is described for concentrating certain low grade uranium and gold bearing ores, in which the gangue is mainly quartz. The production of the concentrate is accomplished by subjecting the crushed ore to a froth floatation process using a fatty acid as a collector in conjunction with a potassium amyl xanthate collector. Pine oil is used as the frothing agent.

14437

INHIBITION OF CORROSION. J. E. Atherton, Jr., and D. H. Gurinsky (to U. S. Atomic Energy Commission). U. S. Patent 2,840,467. June 24, 1958.

A method is described for preventing corrosion of metallic container materials by a high-temperature liquid bismuth flowing therein. The method comprises fabricating the containment means from a steel which contains between 2 and 12% chromium, between 0.5 and 1.5% of either molybdenum and silicon, and a minimum of nickel and manganese, and maintaining zirconium dissolved in the liquid bismuth at a concentration between 50 parts per million and its saturation value at the lowest temperature in the system.

14438

REFRACTORY COATING FOR GRAPHITE MOLDS. Stephen D. Stoddard (to U. S. Atomic Energy Commission). U. S. Patent 2,840,480. June 24, 1958.

Refractory coating for graphite molds used in the casting of uranium is described. The coating is an alumino-silicate refractory composition, which may be used as a mold surface in solid form or as a coating

applied to the graphite mold. The composition consists of a mixture of ball clay, kaolin, alumina cement, alumina, water, sodium silicate, and sodium carbonate.

Physics

14439

REMOTE HANDLING ARRANGEMENTS. D. W. Ginns (to U. S. Atomic Energy Commission). U. S. Patent 2,828,875. Apr. 1, 1958.

A means for handling remotely a sample pellet to be irradiated in a nuclear reactor is proposed. It is comprised essentially of an inlet tube extending through the outer shield of the reactor and being inclined so that its outer end is at a higher elevation than its inner end, an outlet tube extending through the outer shield being inclined so that its inner end is at a higher elevation than its outer end, the inner ends of these two tubes being interconnected, and a straight tube extending through the outer shield and into the reactor core between the inlet and outlet tubes and passing through the juncture of said inner ends. A rod-like member is rotatably and slidely operated within the central straight tube and has a receptacle on its inner end for receiving a sample pellet from the inlet tube. The rod member is operated to pick up a sample pellet from the inlet tube, carry the sample pellet into the irradiating position within the core, and return to the receiving position where it is rotated to dump the irradiated pellet into the outlet tube by which it is conveyed by gravity to the outside of the reactor. Stop members are provided in the inlet tube, and electrical operating devices are provided to control the sequence of the operation automatically.

14440

LEAD SEVERING CONTRIVANCE. W. Widmaier (to U. S. Atomic Energy Commission). U. S. Patent 2,829,293. Apr. 1, 1958.

A means for breaking an electrical circuit within an electronic tube during the process of manufacture is described. Frequently such circuits must be employed for gettering or vapor coating purposes, however, since an external pair of connector pins having no use after manufacture, is undesirable, this invention permits the use of existing leads to form a temporary circuit during manufacture, and severing it thereafter. One portion of the temporary circuit, made from a springy material such as tungsten, is spot welded to a fusable member. To cut the circuit an external radiant heat source melts the fusable member, allowing the tensed tungsten spring to contract and break the circuit. This inexpensive arrangement is particularly useful when the tube has a great many external leads crowded into the tube base.

14441

CONTROL AND FAULT DETECTOR CIRCUIT. C. N. Winningstad (to U. S. Atomic Energy Commission). U. S. Patent 2,829,316. Apr. 1, 1958.

A power control and fault detector circuit for a radio-frequency system is described. The operation of the circuit controls the power output of a radio-frequency power supply to automatically start the flow of energizing power to the radio-frequency power supply and to gradually increase the power to a predetermined level which is below the point where destruction occurs upon the happening of a fault. If the radio-frequency power supply output fails to increase during such period, the control does not further increase the power. On the other hand, if the output of the radio-frequency power supply properly increases, then the control continues to increase the power to a maximum value. After the maximum value of radio-frequency output has been achieved, the control is responsive to a "fault," such as a short circuit in the radio-frequency system being driven, so that the flow of power is interrupted for an interval before the cycle is repeated.

14442

NEUTRONIC REACTOR. E. P. Wigner, A. W. Weinberg, and G. J. Young (to U. S. Atomic Energy Commission). U. S. Patent 2,830,944. Apr. 15, 1958.

A nuclear reactor which uses uranium in the form of elongated tubes as fuel elements and liquid as a coolant is described. Elongated tubular uranium bodies are vertically disposed in an efficient neutron slowing agent, such as graphite, for example, to form a lattice structure which is disposed between upper and lower coolant tanks. Fluid coolant tubes extend through the uranium bodies and communicate with the upper and lower tanks and serve to convey the coolant through the uranium body. The reactor is also provided with means for circulating the cooling fluid through the coolant tanks and coolant tubes, suitable neutron and gamma ray shields, and control means.

14443

RADIATION SOURCES. M. H. Brucer (to U. S. Atomic Energy Commission). U. S. Patent 2,831,122. Apr. 15, 1958.

A novel long-lived source of gamma radiation especially suitable for calibration purposes is described. The source of gamma radiation is denoted mock iodine-131, which comprises a mixture of barium-133 and cesium-137. The barium and cesium are present in a barium–cesium ratio of approximately 5.7/1 to 14/1, uniformly dispersed in an ion exchange resin and a filter surrounding the resin comprised of a material of atomic number below approximately 51, and substantially 0.7 to 0.9 millimeter thick.

14444

TIME-INTERVAL MEASURING DEVICE. J. E. Gross (to U. S. Atomic Energy Commission). U. S. Patent 2,831,162. Apr. 15, 1958.

An electronic device for measuring the time interval between two control pulses is presented. The device incorporates part of a previous approach for time measurement, in that pulses from a constant-frequency oscillator are counted during the interval between the control pulses. To reduce the possible error in counting caused by the operation of the counter gating circuit at various points in the pulse cycle, the described device provides means for successively delaying the pulses for a fraction of the pulse period so that a final delay of one period is obtained and means for counting the pulses before and after each stage of delay during the time interval whereby a plurality of totals is obtained which may be averaged and multiplied by the pulse period to obtain an accurate time-interval measurement.

14445

NEUTRONIC REACTOR. E. P. Wigner (to U. S. Atomic Energy Commission). U. S. Patent 2,831,806. Apr. 22, 1958.

A nuclear reactor for isotope production is described. This reactor is designed to provide a maximum thermal neutron flux in a region adjacent to the periphery of the reactor rather than in the center of the reactor. The core of the reactor is generally centrally located with respect to a surrounding first reflector, constructed of beryllium. The beryllium reflector is surrounded by a second reflector, constructed of graphite, which, in turn, is surrounded by a conventional thermal shield. Water is circulated through the core and the reflector

and functions both as a moderator and a coolant. In order to produce a greater maximum thermal neutron flux adjacent to the periphery of the reactor rather than in the core, the reactor is designed so that the ratio of neutron scattering cross section to neutron absorption cross section averaged over all of the materials in the reflector is approximately twice the ratio of neutron scattering cross section to neutron absorption cross section averaged over all of the material of the core of the reactor.

14446

NEUTRONIC REACTOR. R. J. McGarry (to U. S. Atomic Energy Commission). U. S. Patent 2,831,807. Apr. 22, 1958.

Fluid-cooled nuclear reactors of the type that utilize finned uranium fuel elements disposed in coolant channels in a moderator are described. The coolant channels are provided with removable bushings composed of a non-fissionable material. The interior walls of the bushings have a plurality of spaced, longtudinal ribs separated by grooves which receive the fins on the fuel elements. The lands between the grooves are spaced from the fuel elements to form flow passages, and the size of the flow passages progressively decreases as the distance from the center of the core increases for the purpose of producing a greater cooling effect at the center to maintain a uniform temperature throughout the core.

14447

ELECTROMAGNETIC APPARATUS FOR MOVING A ROD. J. N. Young (to U. S. Atomic Energy Commission). U. S. Patent 2,831,990. Apr. 22, 1958.

An electromagnetic apparatus for moving a rod-like member in small steps in either direction is described. The invention has particular application in the reactor field where the reactor control rods must be moved only a small distance and where the use of mechanical couplings is impractical due to the high-pressure seals required. A neutron-absorbing rod is mounted in a housing with gripping units that engage the rod, and coils for magnetizing the gripping units to make them grip, shift, and release the rod are located outside the housing.

14448

ION SOURCE. E. F. Martina (to U. S. Atomic Energy Commission). U. S. Patent 2,831,996. Apr. 22, 1958.

An improved ion source particularly adapted to provide an intense beam of ions with minimum neutral molecule egress from the source is described. The ion source structure includes means for establishing an oscillating electron discharge, including an apertured cathode at one end of the discharge. The egress of ions from the source is in a pencil like beam. This desirable form of withdrawal of the ions from the plasma created by the discharge is achieved by shaping the field at the aperture of the cathode. A tubular insulator is extended into the plasma from the aperture and in cooperation with the electric fields at the cathode end of the discharge focuses the ions from the source.

14449

TIME CALIBRATED OSCILLOSCOPE SWEEP. H. M. Owren, B. M. Johnson, and V. L. Smith (to U. S. Atomic Energy Commission). U. S. Patent 2,832,002. Apr. 22, 1958.

The time calibrator of an electric signal displayed on an oscilloscope is described. In contrast to the conventional technique of using time-calibrated divisions on the face of the oscilloscope, this invention provides means for directly superimposing equal time spaced markers upon a signal displayed upon an oscilloscope. More explicitly, the present invention includes generally a generator for developing a linear saw-tooth voltage and a circuit for combining a high-frequency sinusoidal voltage of a suitable amplitude and frequency with the saw-tooth voltage to produce a resultant sweep deflection voltage having a wave shape which is substantially linear with respect to time between equal time spaced incremental plateau regions occurring once each cycle of the sinusoidal voltage. The foregoing sweep voltage when applied to the horizontal deflection plates in combination with a signal to be observed applied to the vertical deflection plates of a cathode ray oscilloscope produces an image on the viewing screen which is essentially a display of the signal to be observed with respect to time. Intensified spots, or certain other conspicuous indications corresponding to the equal time spaced plateau regions of said sweep voltage, appear superimposed upon said displayed signal, which indications are therefore suitable for direct time calibration purposes.

14450

FUEL ASSEMBLY FOR A NEUTRONIC REACTOR. E. P. Wigner (to U. S. Atomic Energy Commission). U. S. Patent 2,832,732. Apr. 29, 1958.

A fuel assembly for a nuclear reactor of the type wherein liquid coolant is circulated through the core of the reactor in contact with the external surface of the fuel elements is described. In this design a plurality of parallel plates containing fissionable material are spaced about one-tenth of an inch apart and are supported between a pair of spaced parallel side members generally perpendicular to the plates. The plates all have a small continuous and equal curvature in the same direction between the side members.

14451

HEAVY WATER MODERATED NEUTRONIC REACTOR. L. Szilard (to U. S. Atomic Energy Commission). U. S. Patent 2,832,733. Apr. 29, 1958.

A nuclear reactor of the type which utilizes uranium fuel elements and a liquid coolant is described. The fuel elements are in the form of elongated tubes and are disposed within outer tubes extending through a tank containing heavy water, which acts as a moderator. The ends of the fuel tubes are connected by inlet and discharge headers, and liquid bismuth is circulated between the headers and through the fuel tubes for cooling. Helium is circulated through the annular space between the outer tubes in the tank and the fuel tubes to cool the water moderator to prevent boiling. The fuel tubes are covered with a steel lining, and suitable control means, heat exchange means, and pumping means for the coolants are provided to complete the reactor assembly.

14452

METHOD OF SEPARATING ISOTOPES OF URANIUM IN A CALUTRON. F. A. Jenkins (to U. S. Atomic Energy Commission). U. S. Patent 2,833,927. May 6, 1958.

Mass separation devices of the calutron type and the use of uranium hexachloride as a charge material in the calutron ion source are described. The method for using this material in a mass separator includes heating the uranium hexachloride to a temperature in the range of 60 to 100°C in a vacuum and thereby forming a vapor of the material. The vaporized uranium hexachloride is then ionized in a vapor ionizing device for subsequent mass separation processing.

14453

ELECTRICAL PROTECTIVE DEVICE. W. R. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,833,965. May 6, 1958.

A protective system for high-energy resonant cavities is described. It is particularly directed to the discharging of resonant cavities for preventing energy back flow through associated equipment as a result of faults. The invention in general provides means defining a spark gap communicating with the interior of a cavity or waveguide adapted for high-power energization or an evacuated chamber containing an electrode having a large power differential from the wall or other electrode. A control or trigger circuit is connected between a power supply energizing the cavity and the spark gap whereby reverse current flow in the power supply circuit instantaneously triggers the spark gap to initiate discharge within the cavity, whereupon cavity energy discharges across the gap, or with an electrode present the electrode discharges to one of the spark gap elements.

14454

MULTI-ELECTRODE TUBE PULSE MEMORY CIRCUIT. J. C. Gundlach and J. B. Reeves (to U. S. Atomic Energy Commission). U. S. Patent 2,835,848. May 20, 1958.

Control circuits are described for pulse memory devices for scalers and the like, and more particularly to a driving or energizing circuit for a polycathode gaseous discharge tube having an elongated anode and a successive series of cathodes spaced opposite the anode along its length. The circuit is so arranged as to utilize an arc discharge between the anode and a cathode to count a series of pulses. Upon application of an input pulse the discharge is made to occur between the anode and the next successive cathode, and an output pulse is produced when a particular subsequent cathode is reached. The circuit means for transfering the discharge by altering the anode potential and potential of the cathodes and interconnecting the cathodes constitutes the novel aspects of the invention. A low response time and reduced number of circuit components are the practical advantages of the described circuit.

14455

DIRECTIONAL ANTENNA. B. J. Bittner (to U. S. Atomic Energy Commission). U. S. Patent 2,835,890. May 20, 1958.

A high-frequency directional antenna of the 360° scanning type is described. The antenna has for its desirable features the reduction in both size and complexity of the mechanism for rotating the antenna through its scanning movement. These advantages result from the rotation of only the driven element, the reflector remaining stationary. The particular antenna structure comprises a reflector formed by a plurality of metallic slats arranged in the configuration of an annular cage having the shape of a zone of revolution. The slats are parallel to each other and are disposed at an angle of 45° to the axis of the cage. A directional radiator is disposed inside the cage at an angle of 45° to the axis of the cage in the same direction as the reflecting slats which it faces. As the radiator is rotated, the electromagnetic wave is reflected from the slats facing the radiator and thereafter passes through the cage on the opposite side, since these slats are not parallel with the E vector of the wave.

14456

AIR COOLED NEUTRONIC REACTOR. E. Fermi and L. Szilard (to U. S. AtomicEnergy Commission). U. S. Patent 2,836,554. May 27, 1958.

A nuclear reactor of the air-cooled, graphite moderated type is described. The active core consists of a cubicle mass of graphite, approximately 25 feet in each dimension, having horizontal channels of square cross section extending between two of the opposite faces, a plurality of cylindrical uranium slugs disposed in end to end abutting relationship within said channels providing a space in the channels through which air may be circulated, and a cadmium control rod extending within a channel provided in the moderator. Suitable shielding is provided around the core, as are also provided a fuel element loading and discharge means, and a means to circulate air through the coolant channels through the fuel channels to cool the reactor.

14457

LINEAR ACCELERATOR. S. A. Colgate (to U. S. Atomic Energy Commission). U. S. Patent 2,836,759. May 27, 1958.

An improvement is presented in linear accelerators for charged particles with respect to the stable focusing of the particle beam. The improvement consists of providing a radial electric field transverse to the accelerating electric fields and angularly introducing the beam of particles in the field. The results of the foregoing is to achieve a beam which spirals about the axis of the acceleration path. The combination of the electric fields and angular motion of the particles cooperate to provide a stable and focused particle beam.

14458

NEUTRONIC REACTOR HAVING LOCALIZED AREAS OF HIGH THERMAL NEUTRON DENSITIES. H. W. Newson (to U. S. Atomic Energy Commission). U. S. Patent 2,837,475. June 3, 1958.

A nuclear reactor for the irradiation of materials designed to provide a localized area of high thermal neutron flux density in which the materials to be irradiated are inserted is described. The active portion of the reactor is comprised of a cubicle graphite moderator of about 25 feet in length along each axis which has a plurality of cylindrical channels for accommodating elongated tubular-shaped fuel elements. The fuel elements have radial fins for spacing the fuel elements from the channel walls, thereby providing spaces through which a coolant may be passed, and also to serve as a heat-conducting means. Ducts for accommodating the sample material to be irradiated extend through the moderator material perpendicular to and between parallel rows of fuel channels. The improvement is in the provision of additional fuel element channels spaced midway between 2 rows of the regular fuel channels in the localized area surrounding the duct where the high thermal neutron flux density is desired. The fuel elements normally disposed in the channels directly adjacent the duct are placed in the additional channels, and the channels directly adjacent the duct are plugged with moderator material. This design provides localized areas of high thermal neutron flux density without the necessity of providing additional fuel material.

14459

STEAM STIRRED HOMOGENEOUS NUCLEAR REACTOR. H. M. Busey (to U. S. Atomic Energy Commission). U. S. Patent 2,837,476. June 3, 1958.

A homogeneous nuclear reactor utilizing a self-circulating liquid fuel is described. The reactor vessel is in the form of a vertically disposed tubular member having the lower end closed by the tube walls and the upper end closed by a removal flanged assembly. A spherical reaction shell is located in the lower end of the vessel and spaced from the inside walls. The reac-

tion shell is perforated on its lower surface and is provided with a bundle of small-diameter tubes extending vertically upward from its top central portion. The reactor vessel is surrounded in the region of the reaction shell by a neutron reflector. The liquid fuel, which may be a solution of enriched uranyl sulfate in ordinary or heavy water, is maintained at a level within the reactor vessel of approximately the top of the tubes. The heat of the reaction which is created in the critical region within the spherical reaction shell forms steam bubbles which more upwardly through the tubes. The upward movement of these bubbles results in the forcing of the liquid fuel out of the top of these tubes, from where the fuel passes downwardly in the space between the tubes and the vessel wall where it is cooled by heat exchangers. The fuel then re-enters the critical region in the reaction shell through the perforations in the bottom. The upper portion of the reactor vessel is provided with baffles to prevent the liquid fuel from splashing into this region which is also provided with a recombiner apparatus for recombining the radiolytically dissociated moderator vapor and a control means.

14460

CHAIN REACTING SYSTEM. E. Fermi and M. C. Leverett (to U. S. Atomic Energy Commission). U. S. Patent 2,837,477. June 3, 1958.

A nuclear reactor of the gas-cooled, graphite-moderated type is described. In this design, graphite blocks are arranged in a substantially cylindrical lattice having vertically oriented coolant channels in which uranium fuel elements having through passages are disposed. The active lattice is contained within a hollow body, such as a steel shell, which, in turn, is surrounded by water and concrete shields. Helium is used as the primary coolant and is circulated under pressure through the coolant channels and fuel elements. The helium is then conveyed to heat exchangers, where its heat is used to produce steam for driving a prime mover, thence to filtering means where radioactive impurities are removed. From the filtering means the helium passes to a compressor and an after cooler and is ultimately returned to the reactor for recirculation. Control and safety rods are provided to stabilize or stop the reaction. A space is provided between the graphite lattice and the internal walls of the shell to allow for thermal expansion of the lattice during operation. This space is filled with a resilient packing, such as asbestos, to prevent the passage of helium.

14461

PULSE AMPLITUDE ANALYZERS. G. W. Gray and A. S. Jensen (to U. S. Atomic Energy Commission). U. S. Patent 2,837,639. June 3, 1958.

An analyzer system incorporating a cathode-ray tube and linearly spaced targets masked by a plate having slits at points corresponding to the location of the targets is described. The advantages of the system include reduction in the required amplified band width and also the reduction in possible double counting of a pulse by striking two targets. The system comprises integrating means for each pulse, the signal from which is applied to a pair of deflection plates, and a control circuit for turning on the electron beam when the pulse has almost reached its maximum value. The mask prevents the beam from overlapping on a target adjacent to the proper one, while a control circuit responsive to the target output signals acts to cut off the beam immediately after the beam strikes a target to permit the beam to impinge on only one target.

14462

PULSE HEIGHT ANALYZER. W. W. Goldsworthy (to U. S. Atomic Energy Commission). U. S. Patent 2,837,640. June 3, 1958.

A differential pulse-height discriminator circuit is described which is readily adaptable for operation in a single-channel pulse-height analyzer. The novel aspect of the circuit lies in the specific arrangement of differential pulse-height discriminator which includes two pulse-height discriminators having a common input and an anticoincidence circuit having two interconnected vacuum tubes with a common cathode resistor. Pulses from the output of one discriminator circuit are delayed and coupled to the grid of one of the anticoincidence tubes by a resistor. The output pulses from the other discriminator circuit are coupled through a cathode follower circuit, which has a cathode resistor of such value as to provide a long time constant with the interelectrode capacitance of the tube, to lengthen the output pulses. The pulses are then fed to the grid of the other anticoincidence tube. With such connections of the circuits, only when the incoming pulse has a peak value between the operating levels of the two discriminators does an output pulse occur from the anticoincidence circuit.

14463

GAS COOLED NUCLEAR REACTORS. E. Long and W. Rodwell (to U. S. Atomic Energy Commission). U. S. Patent 2,838,451. June 10, 1958.

A gas-cooled nuclear reactor consisting of a graphite reacting core and reflector structure supported in a containing vessel is described. A gas sealing means is included for sealing between the walls of the graphite structure and containing vessel to prevent the gas coolant by-passing the reacting core. The reacting core is a multi-sided right prismatic structure having a pair of parallel slots around its periphery. The containing vessel is cylindrical and has a rib on its internal surface which supports two continuous ring shaped flexible web members with their radially innermost ends in sealing engagement within the radially outermost portion of the slots. The core structure is supported on ball bearings. This design permits thermal expansion of the core structure and vessel while maintaining a peripheral seal between the two elements.

14464

PLATES WITH OXIDE INSERTS. J. M. West and J. F. Schumar (to U. S. Atomic Energy Commission). U. S. Patent 2,838,452. June 10, 1958.

Planar-type fuel assemblies for nuclear reactors are described, particularly those comprising fuel in the oxide form such as thoria and urania. The fuel assembly consists of a plurality of parallel spaced fuel plate members having their longitudinal side edges attached to two parallel supporting side plates, thereby providing coolant flow channels between the opposite faces of adjacent fuel plates. The fuel plates are comprised of a plurality of longitudinally extending tubular sections connected by web portions, the tubular sections being filled with a plurality of pellets of the fuel material and the pellets being thermally bonded to the inside of the tubular section by lead.

14465

BINARY STORAGE ELEMENT. J. C. Chu (to U. S. Atomic Energy Commission). U. S. Patent 2,838,661. June 10, 1958.

A binary storage device is described comprising a toggle provided with associated improved driver cir-

cuits adapted to produce reliable action of the toggle during clearing of the toggle to one of its two states, or transferring information into and out of the toggle. The invention resides in the development of a self-regulating driver circuit to minimize the fluctuation of the driving voltages for the toggle. The disclosed driver circuit produces two pulses in response to an input pulse: a first or "clear" pulse beginning at substantially the same time but ending slightly sooner than the second or "transfer" output pulse.

14466

MAGNETIC RECORDING HEAD. L. C. Merrill (to U. S. Atomic Energy Commission). U. S. Patent 2,839,614. June 17, 1958.

An electromagnetic recording head is described for simultaneous recording of a plurality of signals within a small space on a magnetically sensitized medium. Basically the head structure comprises a non-magnetic centerpiece provided with only first and second groups of spaced cut-out slots respectively on opposite sides of the centerpiece. The two groups of slots are in parallel alignment and the slots of one group are staggered with respect to the slots of the other group so that one slot is not directly opposite another slot. Each slot has a magnet pole piece disposed therein and cooperating with a second pole and coil to provide a magnetic flux gap at the upper end of the slot. As a tape is drawn over the upper end of the centerpiece the individual magnetic circuits are disposed along its width to provide means for simultaneously recording information on separate portions, tracks, of the tape.

14467

PULSE AMPLIFIER. C. W. Johnstone (to U. S. Atomic Energy Commission). U. S. Patent 2,839,619. June 17, 1958.

The improvement of pulse amplifiers used with scintillation detectors is described. The pulse amplifier circuit has the advantage of reducing the harmful effects of overloading cause by large signal inputs. In general the pulse amplifier circuit comprises two amplifier tubes with the input pulses applied to one amplifier grid and coupled to the second amplifier tube through a common cathode load. The output of the second amplifier is coupled from the plate circuit to a cathode follower tube grid and a diode tube is connected from grid to cathode of the cathode follower tube. Degenerative feedback is provided in the second amplifier by coupling a signal from the cathode follower cathode to the second amplifier grid. The circuit provides moderate gain, stability, and overload protection for subsequent pulse circuits.

14468

PULSED ION SOURCE. C. E. Anderson and K. W. Ehlers (to U. S. Atomic Energy Commission). U. S. Patent 2,839,706. June 17, 1958.

An ion source is described for producing very short high density pulses of ions without beam scattering. The ions are created by an oscillating electron discharge within a magnetic field. After the ions are drawn from the ionization chamber by an accelerating electrode the ion beam is under the influence of the magnetic field for separation of the ions according to mass and, at the same time, passes between two neutralizing plates maintained at equal negative potentials. As the plates are formed of a material having a high ratio of secondary electrons to impinging ions, the ion bombardment of the plates emits electrons which neutralize the fringe space-change of the beam and tend to prevent widening of the beam cross section due to the mutual repulsion of the ions.

14469

REACTOR AND NOVEL METHOD. G. J. Young and L. A. Ohlinger (to U. S. Atomic Energy Commission). U. S. Patent 2,840,522. June 24, 1958.

A nuclear reactor of the type which uses a liquid fuel and a method of controlling such a reactor are described. The reactor is comprised essentially of a tank for containing the liquid fuel such as a slurry of discrete particles of fissionable material suspended in a heavy water moderator, and a control means in the form of a disc of neutron absorbing material disposed below the top surface of the slurry and parallel thereto. The diameter of the disc is slightly smaller than the diameter of the tank and the disc is perforated to permit a flow of the slurry therethrough. The function of the disc is to divide the body of slurry into two separate portions, the lower portion being of a critical size to sustain a nuclear chain reaction and the upper portion between the top surface of the slurry and the top surface of the disc being of a non-critical size. The method of operation is to raise the disc in the reactor until the lower portion of the slurry has reached a critical size when it is desired to initiate the reaction, and to lower the disc in the reactor to reduce the size of the lower active portion the slurry to below criticality when it is desired to stop the reaction.

14470

LOADED WAVEGUIDES. L. B. Mullett, B. G. Loach, and G. L. Adams (to U. S. Atomic Energy Commission). U. S. Patent 2,840,788. June 24, 1958.

Loaded waveguides are described for the propagation of electromagnetic waves with reduced phase velocities. A rectangular waveguide is dimensioned so as to cut-off the simple H_{01} mode at the operating frequency. The waveguide is capacitance loaded, so as to reduce the phase velocity of the transmitted wave, by connecting an electrical conductor between directly opposite points in the major median plane on the narrower pair of waveguide walls. This conductor may take a corrugated shape or be an aperature member, the important factor being that the electrical length of the conductor is greater than one-half wavelength at the operating frequency.

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